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PROCEEDINGS

OF THE

Biological Society of Washington

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VOLUME XXII

1909

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PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

PROCEEDINGS.

The Society meets in the Assembly Hall of the Cosmos Club on alternate Saturdays at 8 P. M. Brief notices of the meetings, with abstracts of the papers, are published in *Science*.

January 9, 1909—452d Meeting.

The President in the chair and 41 persons present.

W. H. Osgood, Vernon Bailey, and the chair offered brief notes on the distribution of the English sparrow in the West.

The following communications were presented:

J. N. Rose: The type of the genus *Cactus*.

W. D. Hunter: Present status of the cotton boll weevil.

F. M. Webster: Investigations of *Toxoptera graminum* and its parasites.

January 23, 1909—453d Meeting.

The President in the chair and 40 persons present.

F. E. Matthes noted the recent occurrence of unusual snow and winter insects in Rock Creek Park.

M. B. Waite exhibited an apple having a peculiar frost injury.

H. M. Smith announced the transfer of the Federal fur-seal service to the Bureau of Fisheries.

B. W. Evermann noted the addition of the barn owl to the known bird fauna of Carroll County, Indiana.

The following communications were presented:

E. F. Phillips: Bee diseases.

B. W. Evermann: Federal control of fisheries in international waters.

H. M. Smith: A remarkable flight of bats in Luzon.

Paul Bartsch: A visit to the bat cave in Luzon.

February 6, 1909 — 454th Meeting.

The President in the chair and 66 persons present.

M. W. Lyon, Jr., exhibited skins and skulls of the Oriental genus *Gymnura* and of the American opossum *Didelphis*, and commented on their resemblances.

O. F. Cook referred to the investigations of Dr. R. R. Gates in the cytology of *Oenothera*.

The chair noted the capture near Washington of the little black rail, a bird rare in this locality.

The following communications were presented:

James Judge: The blue foxes of the Pribilof Islands.

W. J. Spillman: The law of recombination in second generation hybrids.

V. K. Chestnut: The Lewis and Clark Cavern National Monument, Montana.

February 20, 1909 — 455th Meeting.

The President in the chair and 42 persons present.

T. E. Wilcox noted the early appearance of hepaticas and skunk cabbage in the vicinity of Washington.

The following communications were presented:

L. O. Howard: Some Japanese entomologists and their laboratories, with notes on the introduction of parasites of the gypsy moth.

J. B. Norton: Some remarkable phenomena occurring in the breeding of the varieties of *Dianthus*.

March 6, 1909 — 456th Meeting.

The President in the chair and 23 persons present.

T. E. Wilcox read a letter from Col. Gaillard, U. S. Engineer, urging a biological survey of the Isthmus of Panama.

T. N. Gill noted some additions to knowledge of oral gestation in American cichlids.

B. W. Evermann referred to the provision by Congress for a biological station in the Mississippi Valley for the investigation of freshwater mussels.

L. O. Howard remarked on the importation from France of seedlings carrying the winter nests of the brown tail moth.

The chair referred to the creation by President Roosevelt of the Mt. Olympus National Monument.

The following communications were presented:

R. H. Chapman: Chickens without feathers.

T. W. Vaughan: Resumé of a study of the Madreporaria of the Hawaiian Islands.*

A. H. Clark: The recent crinoids and their relation to sea and land.

March 20, 1909 — 457th Meeting.

The President in the chair and 85 persons present.

W. W. Cooke noted the spring arrivals of migratory birds in the vicinity of Washington.

H. W. Clark commented on the mortality of grackles on the Mall.

A. S. Hitchcock, Vernon Bailey, H. S. Barber, W. H. Osgood, J. W. Gidley and E. A. Preble participated in a discussion of "camping and camping outfits."

April 3, 1909 — 458th Meeting.

The President in the chair and 36 persons present.

A. A. Doolittle showed some blue print lantern slides and explained the method of making them.

The following communications were presented:

T. N. Gill: Classification of the true fishes.

R. E. Coker: The guano-birds of Peru.

April 17, 1909 — 459th Meeting.

The meeting was held in Hubbard Memorial Hall, the President in the chair and 155 persons present.

The following communication was presented:

Charles Sheldon: Experiences with big game in the Mt. McKinley region, Alaska.

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* To be published in the Proceedings of the Seventh International Zoological Congress.

May 1, 1909—460th Meeting.

The President in the chair and 53 persons present.

The following communication was presented:

Frank N. Meyer: Botanical exploration in Manchuria and other parts of China.

The meetings for the remainder of the year were held in the West Hall of George Washington University.

November 13, 1909—461st Meeting.

The President in the chair and 35 persons present.

The following communications were presented:

W. J. Spillman: The history of the mule-footed hog.

W. P. Hay: A phylogenetic tree adapted for use in schools.

W. W. Cooke: The migrations and recent history of the Eskimo curlew.*

November 27, 1909—462d Meeting.

The President in the chair and 38 persons present.

A. S. Hitchcock gave an example illustrating the difficulty of obtaining stability in nomenclature.

Paul Bartsch referred to the early work of D. H. Talbot in breeding solid-hoofed hogs.

A. H. Howell described a case of semi-domestication of the myrtle warbler in Union Station at Washington. H. W. Clark noted a similar case in Indiana.

The chair called attention to two forest reserves in Minnesota and Ontario adjoining the boundary, consummating in effect the first international game preserve.

The following communications were presented:

A. H. Howell: Observations on the mammals of the Mammoth Cave.

C. V. Piper: The distribution of color in the seeds of the cowpea.

F. M. Webster: A painful skin disease caused by a predaceous and supposedly beneficial mite.

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*To be published by the Biological Survey.

December 11, 1909—463d Meeting.

THIRTIETH ANNUAL MEETING.

President Palmer in the chair and 17 persons present.

The annual reports of the Recording Secretary and Treasurer were read and accepted. The following officers were elected for the year 1910:

President: T. S. Palmer.

Vice-Presidents: E. L. Greene, E. W. Nelson, W. P. Hay, J. N. Rose.

Recording Secretary: D. E. Lantz.

Corresponding Secretary: Austin H. Clark.

Treasurer: J. W. Gidley.

Members of the Council: A. K. Fisher, Vernon Bailey, David White, A. D. Hopkins, A. B. Baker.

The President announced as standing committee on Publications, the following: W. P. Hay, Austin H. Clark, J. W. Gidley.

VOL. XXII, PP. 1-22 JANUARY 9, 1909

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

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A REVISION OF THE CRINOID FAMILIES THALASSOMETRIDÆ AND HIMEROMETRIDÆ.

BY AUSTIN HOBART CLARK.

In my first revision of the unstalked crinoids (Smiths. Miscell. Coll., Quarterly Issue, L, pp. 343-364; Bull. Mus. Comp. Zool., LI, No. 8, p. 245), I was, through lack of material, unable to arrive at a true understanding of the interrelations of the specific groups which I called collectively *Antedon*, and various other groups which I segregated into the "genera" *Himerometra*, *Thalassometra*, and *Charitometra*. These genera were sufficiently definite and well marked to serve as units, and I therefore had no hesitation in considering them as such until further material was available upon which to base a more detailed study. This was soon possible in the case of "*Antedon*," and that genus was promptly resolved into its component specific groups (these Proceedings, XXI, pp. 125-136); but the other genera, from a lack of adequately representative material, proved more difficult; of "*Himerometra*" especially, I was only acquainted with a very small proportion of the very numerous species. The receipt of a very interesting collection from the Hawaiian Islands, and of the extensive Japanese collection deposited by Mr. Frank Springer threw considerable light on a number of hitherto obscure points in regard to "*Thalassometra*" and "*Charitometra*"; more recently, through the kindness of Dr. Th. Mortensen, I have been able to study the magnificent collection belonging to the University of Copenhagen, and the U. S. Bureau of Fisheries has entrusted to me the collections made by the steamer *Albatross* among the Philippine Islands, so that I now have been able to examine all of the important types referred to *Himerometra*.

The new genera described herein are based upon obvious external characters, in order that they may be readily recognized and identified from ordinary museum material; in many cases, as with the larger divisions, the best characters are found in the musculature, studied from the point of view of skeletal muscle insertions, and in the internal structure of the centro-dorsal; but it has seemed best to omit a discussion of these features from preliminary diagnoses, though I shall consider them in detail later, especially in reference to the fossil comatulids, in which often only the centro-dorsal and the radials are preserved.

The family Thalassometridæ falls into two approximately equal divisions, in one of which all the species have short, stout, and smooth cirri, and a slender first pinnule composed of very numerous short joints; and in the other long, comparatively slender, and spiny cirri, and a stout first pinnule, composed of enlarged joints. In the latter the proximal cirrus joints, for a variable distance from the centro-dorsal, are rounded, spineless, and with a dull surface, and usually comparatively dark in color; then comes a "transition" joint, which is similar to those preceding for most of its length, but distally has a highly polished surface, is light in color, and bears a small dorsal spine or tubercle; beyond this "transition" joint the joints are shorter, highly polished, and bear dorsal spines, and the cirrus is more slender than in the proximal portion. This group thus appears to have the cirri of the other modified, not by a simple increase in the number of joints, but by the addition of a series of a different type of joint beyond the penultimate joint of the former (corresponding to the "transition" joint of the latter). This increased cirrus length is correlated, as is commonly the case among the comatulids, with an increase in the size of the lower pinnules (though here affecting only the first) and the result is an animal of radically different appearance. I propose to group the forms with short, stout, smooth cirri and slender many-jointed first pinnule together under the designation of *Charitometrinæ*, while those with long, comparatively slender, spiny cirri, and long and stout first pinnule may be taken as composing the sub-family *Thalassometrinæ*.

This modification of the cirri and lower pinnules is not by any means confined to the Thalassometridæ; it is equally marked in the Zygometridæ, where it separates *Eudiocrinus* and *Catoptometra* from *Zygometra*, and, with more or less modification, in certain sections of the Himerometridæ.

I have used great care in the selection of the types of the new genera described herein. The types are, wherever possible, the first species to have been described, and the commonest species; but in cases where the original description is deficient, or the identification doubtful, I have taken one of the later species, where circumstances permitted one considered as a synonym of the first described. Preference has always been given to species at hand to guard against the possibility of nomenclatorial disturbance through misconception of species not personally known to me, as so much trouble has arisen in other groups because of certain species being supposed by authors to be one thing, but on examination proving to be something quite different.

FAMILY HIMEROMETRIDÆ.

KEY TO THE INCLUDED GENERA.

a^1 P_1 greatly elongated, P_2 and following pinnules extremely short, only about one-fifth as long as P_1; cirri long and stout, with about 80 joints; anal tube very long and slender; rays rounded and very widely separated (1) *Pontiometra.*

a^2 P_2 resembling P_1 equal in size, or larger; anal tube stout, not especially long; rays never very widely separated.

- b^1 no pinnule on the fourth (epizygal) brachial (i. e., P_a absent).
  - c^1 cirri long with more than 35 joints; all the pinnules long and stiff, none of the proximal pinnules greatly longer than the others (2) *Colobometra.*
  - c^2 cirri short, with less than 30 joints; distal pinnules soft and delicate; one or two of the proximal pinnules much larger and stiffer than the others (3) *Cyllometra.*
- b^2 a pinnule on the fourth (epizygal) brachial (i. e. P_a present).
  - c^1 middle and distal brachials extremely short and oblong; I Br and lower brachials strongly convex dorso-ventrally, appearing swollen.
    - d^1 I Br and first two brachials in apposition for their entire length; synarthrial tubercles strongly developed; P_1 smaller and more slender than P_2; 10–20 arms (4) *Amphimetra.*
    - d^2 I Br and division series rounded, and widely separated laterally; synarthrial tubercles not developed; P_1 resembling P_D and P_P and larger than P_2; more than 25 arms (5) *Himerometra.*
  - c^2 middle and distal brachials wedge-shaped or triangular, not particularly short; I Br, further division series, and lower brachials not swollen.
    - d^1 10 arms; cirri short and stout, the component joints sub-equal, usually squarish, sometimes broader than long; opposing spine median, erect; joints of lower pinnules with more or less developed keels or lateral processes (6) *Oligometra.*

- d^2 more than 10 arms; opposing spine, when present, sub-central to sub-terminal, more or less directed forward.
  - e^1 cirrus joints all much broader than long, sub-equal; cirrus spines paired; P_2 greatly enlarged and stiff (7) *Cenometra.*
  - e^2 distal cirrus joints shorter than (or longer than) the proximal, the latter at least as long as broad; dorsal cirrus spines single, or absent.
    - f^1 cirri stout basally, tapering gradually to a point distally; terminal claw nearly straight (8) *Craspedometra.*
    - f^2 cirri not tapering distally.
      - g^1 one or more of the proximal pinnules very stiff, straight, sharp-pointed, and spine-like, though not especially enlarged; lateral processes on the I Br and further division series (9) *Stephanometra.*
      - g^2 proximal pinnules always taper distally to a slender and delicate tip; no lateral processes on the I Br and further division series.
        - h^1 II Br 4 (3 + 4); P_D smaller than P_1; P_2 the longest; arm division very irregular (10) *Heterometra.*
        - h^2 II Br and subsequent division series 2; arm division regular (11) *Dichrometra.*

SUPPLEMENTARY KEY TO GENERA WITH TEN ARMED REPRESENTATIVES.

- a^1 no pinnule on the fourth (epizygal) brachial (i. e., P_a absent).
  - b^1 cirri long, with more than 35 joints; all the pinnules long and stiff, none of the proximal pinnules greatly longer than the others (2) *Colobometra.*
  - b^2 cirri short, with less than 30 joints; distal pinnules soft and delicate; one or two of the proximal pinnules much longer and stiffer than the others (3) *Cyllometra.*
- a^2 a pinnule on the fourth (epizygal) brachial (i. e., P_a present).
  - b^1 middle and distal brachials extremely short and discoidal; I Br and lower brachials swollen (4) *Amphimetra.*
  - b^2 middle and distal brachials wedge-shaped or triangular, not particularly short (6) *Oligometra.*

SUPPLEMENTARY KEY TO GENERA WITH II BR 4 (3+4).

- a^1 P_D larger and longer than P_1, which, in turn, is larger and longer than P_2 (5) *Himerometra.*
- a^2 P_D smaller and weaker than P_1, which, again, is smaller and weaker than P_2.
  - b^1 cirri uniform, not tapering distally; distal cirrus joints not so long as broad; opposing spine present.
    - c^1 middle and distal brachials exceedingly short, discoidal; I Br and lower brachials swollen (4) *Amphimetra.*
    - c^2 middle and distal brachials not especially short, more or less obliquely wedge-shaped; I Br and lower brachials not swollen (10) ***Heterometra.***
  - **b^2 cirri tapering distally; distal cirrus joints twice as long as broad; no opposing spine (8) *Craspedometra.***

SUPPLEMENTARY KEY TO GENERA WITH II BR 2.

a^1 P_1 greatly elongated; P_2 and following pinnules extremely short, of uniform length; cirri long and stout, with about 80 joints (1) *Pontiometra.*

a^2 P_2 resembling P_1 in size, or larger; cirri short, with less than 50 joints.

b^1 no pinnule on the fourth (epizygal) brachial (i. e., P_a absent) (3) *Cyllometra.*

b^2 a pinnule on the fourth (epizygal) brachial (i. e., P_a present).

c^1 cirrus joints all much broader than long, sub-equal; cirri stout; cirrus spines paired; P_2 greatly enlarged, the component joints with overlapping and spinous distal ends (7) *Cenometra.*

c^2 proximal cirrus joints longer than the distal, longer than broad; P_2 enlarged, though not greatly different from one or two neighboring pinnules, which may equal or even exceed it; P_2 has smooth joints.

d^1 one or more of the proximal pinnules very stiff, straight, sharp-pointed, and spine-like, though not especially enlarged; I Br and division series with lateral processes (9) *Stephanometra.*

d^2 proximal pinnules, though enlarged, taper evenly to a slender and delicate tip; I Br and division series without lateral processes (11) *Dichrometra.*

1. **Pontiometra** A. H. Clark.

The species belonging to this genus is:

Pontiometra andersoni (P. H. Carpenter).

2. **Colobometra** gen. nov.

Genotype.—Antedon perspinosa P. H. Carpenter, 1881.

Centro-dorsal discoidal, more or less thickened, usually with a slightly concave polar area; cirrus sockets arranged in one, sometimes two, closely crowded, alternating rows.

Cirri XV–XXV, 35–60, the joints with prominent and overlapping distal ends thickly set with fine spines; distal cirrus joints about twice as broad as long, always shorter than the proximal, which may be not quite so long as broad to somewhat longer than broad; prominent dorsal spines, usually paired, developed in the distal half or two-thirds of the cirri. The cirri are equal to about one-fourth of the arm length.

Radials visible in the angles of the calyx, but usually concealed in the median line; I Br_1 rounded dorsally, entirely separate, decreasing slightly in diameter anteriorly, twice or three times as broad as long; I Br_2 pentagonal, nearly twice as broad as long to nearly as long as broad; both these joints have slight marginal projections, and are widely free laterally.

Arms 10; first eight or nine brachials almost oblong, about twice as broad as long, then becoming triangular, about twice as broad as long, then wedge-shaped, though without any especial increase in length until near the extremity of the arm where they become almost as long as broad, though remaining obliquely wedge-shaped. The brachials have projecting and spiny overlapping distal edges, which become very marked after the second syzygy.

P_a absent; P_1 not especially long, and not stiffened, evenly tapering, and rather slender distally, the component joints squarish or rather longer than broad; following lower pinnules rather long, sub-equal, slightly enlarged, and very stiff, the elongated component joints with overlapping and spinous distal ends; middle and distal pinnules not very different in length from the proximal, but more slender; they are stiffened and flattened laterally, with moderately long joints which have projecting and spinous distal ends.

Color (in spirits).—Flesh color to deep purple, the costals and lower brachials usually with a darker lateral line, the arms after the second syzygy with numerous and thickly set, rather narrow, bands of darker.

Distribution.—Port Denison (near Bowen), Queensland, to Amboina, New Guinea (Jobie), Singapore and the Philippine Islands.

Depth.—Littoral, but occurring down to 20 fathoms.

The species included in this genus are:

Colobometra perspinosa (P. H. Carpenter)
" *suavis* (A. H. Clark).

3. **Cyllometra** A. H. Clark.

The species remaining in this genus as restricted are:

Cyllometra albopurpurea A. H. Clark
" *anomala* A. H. Clark
" *claræ* (Hartlaub)
" *impinnata* (P. H. Carpenter)
" *informis* (P. H. Carpenter)
" *manca* (P. H. Carpenter)
" *tigrina* (A. H. Clark).

4. **Amphimetra** gen. nov.

Genotype.—Comatula (Alecto) milberti J. Müller, 1846.

Centro-dorsal hemispherical or more or less discoidal, the moderately large polar area flat, slightly convex, or slightly concave; cirrus sockets arranged in one to three crowded, more or less alternating, marginal rows.

Disk often more or less plated.

Cirri XIII–XXX, 25–50, short, varying from slender and tapering to very stout. The component joints may be sub-equal, all very short, or all longer than broad, or the proximal joints may be longer than broad, the distal short; dorsal spines are usually (though not always) developed, at least distally; but, though prominent, they are never very large.

Arms 10 to 20; but the division series, when developed, are very irregular in occurrence; II Br 4 (3+4); III Br 2, developed interiorly in 1, 2, 2, 1 order; I Br and lower brachials (including division series) in lateral apposition, and more or less "wall-sided"; I Br, division series, and proximal brachials rather strongly convex longitudinally as well as transversely, giving them a characteristic swollen appearance, like the corresponding joints in *Himerometra;* brachials all short, at first discoidal, then more or less wedge-shaped, becoming very short and regularly discoidal in the outer half of the arm as in *Himerometra;* synarthrial tubercles prominent, sometimes excessively developed.

P_1 small and slender, with numerous short joints; P_2, P_3, or both, elongate, rather large basally, but tapering, and slender distally; the distal ends of the outer joints may be produced into broad lateral expansions, and the proximal joints may be carinate.

Color (in spirits).—White to dark reddish brown, purple, or violet; ashey gray, white, or pale flesh color blotched or banded with purple (light or dark) or yellowish brown; pale flesh color, the perisome and pinnules brown or deep violet.

Distribution.—Ceylon to the Mergui Archipelago, Sumatra, and Singapore, Port Denison, Port Molle, the Arafura Sea and Aru Islands, Ceram, the Philippines, Borneo, and northward to Canton and Japan.

Depth.—Littoral, and down to at least 32, possibly 36 fathoms.

Though well marked in regard to the generic characters, the genus *Amphimetra* presents exceptional difficulties in the elucidation of the interrelations of its component species, and no satisfactory synopsis of them has up to the present been published. The species at present known are:

Amphimetra anceps (P. H. Carpenter)
" *ensiformis* (A. H. Clark)
" *laevissima* (J. Müller)
" *milberti* (J. Müller)
" *mölleri* (A. H. Clark)
" *producta* (A. H. Clark)
" *schlegelii* (A. H. Clark)
? " *tessellata* (J. Müller)
" *variipinna* (P. H. Carpenter).

5. **Himerometra** A. H. Clark.

The species belonging to this genus as restricted are:

Himerometra bartschi A. H. Clark
" *crassipinna* (Hartlaub)
" *kraepelini* (Hartlaub)
" *magnipinna* A. H. Clark
" *martensi* (Hartlaub)
" *persica* A. H. Clark
" *robustipinna* A. H. Clark
? " *philiberti* (J. Müller).

6. **Oligometra** A. H. Clark.

The species of this genus are:

Oligometra adeonæ (Lamarck)
" *bidens* (Bell)
" *caribbea* A. H. Clark
" *carpenteri* (Bell)
" *gracilicirra* A. H. Clark
Oligometra imbricata A. H. Clark
" *japonica* (Hartlaub)
" *pinniformis* (P. H. Carpenter)
" *pulchella* A. H. Clark
" *serripinna* (P. H. Carpenter).

7. **Cenometra** gen. nov.

Genotype.—*Himerometra unicornis* A. H. Clark, 1908.

Centro-dorsal of moderate size, rather thick, discoidal, the dorsal pole strongly concave; cirrus sockets arranged in one or two closely crowded alternating marginal rows.

Cirri xv–xx, 30–45, stout, between one-fifth and one-sixth the length of the arms; cirrus joints subequal, all about twice as broad as long; all the joints with prominent distal ends, giving the cirri a strongly serrate appearance dorsally; joints of the outer half or two-thirds with paired tubercles or small spines.

Radials just visible, separated distally; I Br_1 entirely free laterally, rounded dorsally, two or three times as broad as long; I Br_2 little, if any, longer than the first costals; II Br always, III Br and IV Br sometimes, present, all 2, the last two developed only on the outer sides of each I Br series; synarthrial tubercles not developed; division series and first brachials bearing externally stout lateral processes as in *Stephanometra*, progressively decreasing in size.

Arms 20 to 30; first eight or nine brachials approximately oblong, about twice as broad as long, then becoming wedge-shaped, about twice as broad as long, and distally less obliquely wedge-shaped. The brachials have projecting and finely spinous distal ends. The second syzygy is at a considerable distance from the calyx, varying from between the fourteenth and fifteenth to between the ninety-second and ninety-third, but usually in the vicinity of the thirtieth brachial.

P_2 very large, stout and stiff, with twelve to twenty joints, most of which are a little longer than broad, and have projecting and finely spinous distal ends; P_1 is slender and weak, tapering, but with at least as many joints as P_2; P_3 and the following pinnules are slender and weak, smaller than P_1; distal pinnules nearly as long as P_2.

Color (in spirits).—Light grayish blue, with very numerous small round red-brown spots, cirri yellow-brown; or reddish-brown, the cirri yellow-brown; P_2 is always light yellow-brown.

Distribution.—Ceylon, eastward to Amboina and the Philippine Islands, and northward to the Gulf of Tonkin.

Depth.—Littoral, and down certainly to 29, and possibly to 36 fathoms.

The described species belonging to this genus are:

Cenometra abbotti (A. H. Clark)
" *bella* (Hartlaub)
" *brunnea* (Hartlaub)
" *unicornis* (A. H. Clark).

8. **Craspedometra** gen. nov.

Genotype.—*Antedon acuticirra* P. H. Carpenter, 1882.

Centro-dorsal a large thick disk with a flat or slightly convex dorsal surface, the cirrus sockets usually in a single marginal row, rarely in two irregular rows.

Cirri xv–xxv, 35–60, long and slender, stout basally, distally tapering gradually to a point; cirrus joints very short basally, becoming gradually longer, and longest terminally; dorsal spines or carination absent; no opposing spine; terminal claw long (about as long as the penultimate joint) and nearly straight. The cirri are over one-third, and often nearly one-half the arm length.

Radials more or less completely concealed; I Br_1 very short, united laterally; I Br_2 short, free laterally; II Br 4 (3 + 4); III Br 2, rarely 4 (3 + 4); IV Br 2; the division series are usually very irregular on different rays. I Br and division series rounded dorsally, well separated laterally, with often a slight prominence of the synarthrial articulations.

Arms 26 to 35, long, moderately slender; first eight brachials approximately oblong (the first two wedge-shaped), two or three times as broad as long, then becoming obliquely wedge-shaped or triangular, but of the same proportions, distally becoming less obliquely wedge-shaped, and almost (though never quite) oblong in the distal half of the arm.

P_D stout basally, but becoming slender in the distal half, all the joints short, the broad lower joints carinate; P_1 similar, but longer; P_2 long and rather stout, but gradually tapering distally, composed of very numerous short joints, those in the basal half being carinate; P_3 similar, but longer and rather stouter, reaching to about half the cirrus length, composed of numerous joints; following pinnules decreasing in length and stoutness, the distal pinnules being only about one-third as long as the elongate proximal pinnules. The carination of the basal joints of the lower pinnules is traceable to about the end of the proximal third of the arm.

Color (in spirits).—Nearly white, with traces of deep violet; flesh-colored, the perisome brown; light brown; deep purple, almost black; or purplish brown.

Distribution.—Sydney, New South Wales, northward to Amboina, Singapore and Hong Kong.

Depth.—Littoral.

Lack of material has prevented my confirming or disproving Hartlaub's disposition of the described species of this genus; I therefore list all of the nominal species referable to this genus which have been described:

Craspedometra acuticirra (P. H. Carpenter)
" *australis* (P. H. Carpenter)
" *bipartipinna* (P. H. Carpenter)
" *ludovici* (P. H. Carpenter).

9. **Stephanometra** gen. nov.

Genotype.—*Antedon monacantha* Hartlaub, 1890.

Centro-dorsal moderate to small, discoidal with sloping sides, or sub-hemispherical, the dorsal polar area small, usually flat or slightly convex, more rarely slightly concave; cirrus sockets arranged in one and a partial second to two and a partial third closely crowded alternating rows.

Cirri xv–xxxv, 15–25, rather small and weak, scarcely reaching one-fifth of the arm length; proximal cirrus joints (except the basal) somewhat longer than the distal, but the latter never much broader than long; cirri usually strongly carinate distally, rarely spiny.

I Br and division series dorsally rounded, the synarthrial tubercles sometimes slightly developed, always well separated laterally, the outer edges of the joints furnished with more or less developed ventro-lateral tubercular prominences or lateral flanges.*

Arms 12 to 31; first seven to nine brachials approximately oblong (the first two wedge-shaped), about twice as broad as long, then becoming triangular or very obliquely wedge-shaped, broader than long, and distally wedge-shaped, and in the terminal portion of the arm, as long as, or even rather longer than, broad, though remaining moderately oblique.

P_2 the longest, stout, very stiff and spine-like, tapering to a sharp point, with comparatively few joints (not over eighteen), most of which are much elongated; P_1 is usually somewhat shorter than P_2 with more numerous and shorter joints, more slender and more flexible, but it is occasionally similar to P_2; P_3 usually, and often one or two of the following pinnules are of the same character as P_2, but of decreasing length; the distal pinnules are slender, delicate, and flexible, not so long as P_2.

Color (in spirits).—Yellow or white, with narrow bands of red-brown or blackish-brown at the articulations; sometimes deep violet or almost black, or yellow or reddish with darker bands at the articulations.

Distribution.—Island of Rodriguez, eastward to the Nicobar Islands, Singapore, Amboina, Torres Straits, the Banda Sea, Fiji, the Tonga Islands, the Carolines, and the Philippines.

Depth.—Littoral, extending downward to 21 fathoms.†

The described species belonging to this genus are:

Stephanometra acuta (A. H. Clark)
" *echinus* (A. H. Clark)
" *indica* (Smith)
" *monacantha* (Hartlaub)
" *oxyacantha* (Hartlaub)
" *spicata* (P. H. Carpenter)
" *spinipinna* (Hartlaub)
" *tenuipinna* (Hartlaub)
" *tuberculata* (P. H. Carpenter).

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*Absent in the type of *Antedon spinnipinna;* but this is evidently a very young specimen.

NOTE.—A second large specimen of this species, received since the above was put in type, has the lateral flanges developed as usual.

†Dr. Carpenter records *S. tuberculata* from 210, 255, or 610 fathoms, near Kandavu, Fiji, but the shallowest of these is so much below the lowest certain record for any species of the family that the record must be considered doubtful, on the basis of our present knowledge.

10. **Heterometra** gen. nov.

Genotype.—*Antedon quinduplicava* P. H. Carpenter, 1888.

Centro-dorsal discoidal, thin to moderately thick, the dorsal polar area sometimes flat, but usually more or less convex, the sides sloping, the cirrus sockets arranged in one and a partial second to two and a partial third closely crowded alternating rows.

Cirri XVII–XXX, 20–37, about one-fourth the length of the arms; proximal cirrus joints (except the basal) slightly longer than broad, becoming broader than long distally; distal cirrus joints always sharply carinate, and usually developing more or less prominent spines.

Radials but slightly, when at all, visible; I Br_1 short, more or less united, but always free distally, rarely reaching a length of one-half the width; I Br_2 pentagonal, half again to twice as long as the I Br_1, rounded dorsally, widely free laterally; I Br and division series smooth laterally, without marginal projections; II Br 4 (3+4), rarely 2; III Br (when present) always 2. The development of II Br and III Br series is irregular, some of the I Br series being always better supplied than the others.

Arms 11 to 28, though usually rather less than 20; first few brachials discoidal, then obliquely wedge-shaped or triangular, much broader than long, gradually becoming less obliquely wedge-shaped, sometimes almost oblong, and short, though they are never excessively short and discoidal as in *Himerometra.*

P_D shorter and more slender than P_1, which, in turn, is shorter and more slender than P_2, the last being the largest pinnule on the arm; lower pinnules stout basally, tapering gradually to a slender and more or less flagellate tip; the enlarged lower part usually more or less stiffened, this stiffening becoming less and less distally. Distal pinnules always much shorter than the enlarged proximal pinnules, usually not much more than one-half as long.

Color (in spirits).—Light brown to chocolate brown, the perisome usually darker; light grayish brown; blackish brown, with a tinge of reddish; dull orange, broadly banded with white.

Distribution.—Red Sea eastward (Muscat; Kurrachee; Ceylon; Bay of Bengal) to Amboina and the Philippine Islands.

Depth.—Littoral, extending down to 24 fathoms.

The described species referable to this genus are:

Heterometra affinis (Hartlaub)
" *bengalensis* (Hartlaub)
" *brockii* (Hartlaub)
" *quinduplicava* (P. H. Carpenter)
" *reynaudi* (J. Müller)
" *savignii* (J. Müller).

From the two other genera which have the II Br series 4 (3+4) *Heterometra* may be very readily distinguished. *Himerometra* always has the brachials exceedingly short and discoidal, usually a much larger number of arms, and P_D longer and stouter than P_a or P_1, which, again, are longer and stouter than the succeeding pinnules; the III Br series, always present, are inwardly 2, outwardly 4 (3+4), whereas in *Heterometra* they are always 2. *Amphimetra* has the same excessively short discoidal brachials as *Himerometra*, whereby it is very easily differentiated from *Heterometra*, though the III Br series are 2, and P_D is smaller than P_1 as in the latter.

11. **Dichrometra** gen. nov.

Genotype.—Alecto flagellata J. Müller, 1841.

Centro-dorsal moderate or small, low-hemispherical or discoidal, the bare polar area small, slightly convex, flat, or slightly concave, the sides sloping; cirrus sockets arranged in two or three crowded, alternating, marginal rows.

Cirri XX–XL, 17–52 (usually 20–30), rather slender and weak, from one-sixth to about two-fifths the length of the arms, the distal joints always somewhat shorter than the proximal (except the basal), though never very short, sharply carinate, or furnished with more or less prominent spines, which, however, are never so long as the opposing spine.

Radials usually concealed, sometimes slightly visible; division series always 2, the component joints without lateral processes, though sometimes rather sharply carinate ventro-laterally, never very widely separated, usually more or less in apposition and laterally flattened.

Arms 25 to 43, supernumerary axillaries being always developed exteriorly in regard to the I Br axillary; first two brachials wedge-shaped, the longer side out; following five or six oblong, about twice as broad as long, then becoming triangular or very obliquely wedge-shaped, about twice as broad as long, then becoming less obliquely wedge-shaped distally, and slightly longer, though even the terminal joints have oblique ends and are scarcely, if any, longer than broad.

Proximal pinnules much elongated, though not especially enlarged, and flagellate, occasionally somewhat stiffened basally, with twenty-five or more joints, squarish or slightly longer than broad; P_1 always shorter and more slender than P_2, the latter being less than, equal to, or longer than P_3; P_2 usually somewhat, occasionally very much, larger, on the outer arms of each ray than on the inner; the distal pinnules are short, never so long as the elongated proximal pinnules.

Color (in spirits).—Various shades of yellow, yellowish, reddish, or blackish brown, or grayish to deep purple or violet, often more or less mottled with darker or with yellow or white. The long lower pinnules and cirri are usually lighter than the remaining portions of the animal.

Distribution.—Madagascar northward to the Red Sea, eastward along the coasts of India, Ceylon, and northern Australia to the coast of China, Japan, Fiji, the Philippines, the Tonga and the Marshall Islands.

Depth.—Littoral, and extending downward to at least 28 fathoms.*

The species referable to this genus are:

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* Chadwick records *D. okelli* from a station at which the recorded depth was 11½–36 fathoms; Carpenter records *D. occulta* from a depth of 210, 255, or 610 fathoms; but additional confirmation of even the lowest of these last is needed.

Dichrometra articulata (J. Müller)
" *bimaculata* (P. H. Carpenter)
" *brevicuneata* (P. H. Carpenter)
" *elongata* (J. Müller)
" *flagellata* (J. Müller)
" *gracilipes* (A. H. Clark)
" *grandis* (A. H. Clark)
" *gyges* (Bell)
" *heliaster* (A. H. Clark)
" *klunzingeri* (Hartlaub)
" *marginata* (P. H. Carpenter)
" *occulta* (P. H. Carpenter)
" *okelli* (Chadwick)
" *palmata* (J. Müller)
" *protectus* (Lütken)
" *regalis* (P. H. Carpenter)
" *reginæ* (Bell)
" *subcarinata* (A. H. Clark)
" *subtilis* (Hartlaub)
" *tenera* (Hartlaub).

The following species belonging to this family I have not been able to place satisfactorily, through lack of material for comparison; the first appears to be most closely related to *Pontiometra andersoni*, and the diagnosis of that genus may have to be altered for its reception; the second appears to represent a distinct generic type, for which the name **Oxymetra** would be appropriate.

Antedon finschii Hartlaub *Antedon erinacea* Hartlaub.

FAMILY THALASSOMETRIDÆ.

SUB-FAMILY THALASSOMETRINÆ.

KEY TO THE INCLUDED GENERA.

a^1 Calyx and arm bases spinous, the latter rounded dorsally.
  b^1 genital pinnules expanded; brachials with single long overlapping median spines; P_1 long, but not enlarged (12) *Stylometra.*
  b^2 genital pinnules styliform, not expanded; brachials rounded dorsally; spines when present on the brachials, two or more in number; P_1 long and greatly enlarged (13) *Thalassometra.*
a^2 Calyx and arm bases smooth.
  b^1 I Br strongly carinate.
    c^1 P_1 only slightly larger than P_2; arms strongly carinate throughout (14) *Stenometra.*
    c^2 P_1 much longer than P_2; arms rounded, not carinate (15) *Stiremetra.*
  b^2 I Br not carinate.
    c^1 less than 30 cirrus joints; genital pinnules short; usually less than twenty arms; lateral flattening of rays not marked (16) *Parametra.*

c^2 more than 40 cirrus joints; genital pinnules moderately long; twenty or more arms; rays and division series sharply flattened laterally (17) *Cosmiometra.*

(12) Stylometra A. H. Clark.

The species belonging to this genus, in addition to an undescribed form from the Caribbean Sea, is :

Stylometra spinifera (P. H. Carpenter).

(13) Thalassometra A. H. Clark.

The species remaining in this genus as restricted are :

Thalassometra agassizii (Hartlaub)
“ *aster* (A. H. Clark)
“ *bispinosa* (P. H. Carpenter)
“ *echinata* (P. H. Carpenter)
“ *gigantea* (A. H. Clark)
“ *hawaiiensis* (A. H. Clark)
“ *multispina* (P. H. Carpenter)
“ *pergracilis* (A. H. Clark)
“ *pubescens* (A. H. Clark)
“ *villosa* (A. H. Clark).

14. Stenometra gen. nov.

Genotype.—Antedon quinquecostata P. H. Carpenter, 1888.

Centro-dorsal small, truncated-conical or more or less columnar, the cirrus sockets arranged in ten definite columns of two or three each, each column separated from its neighbors by more or less developed ridges, those situated interradially being usually more prominent than the others.

Cirri XX–XXXV, 50–90, long and slender; first few joints very short, then becoming much longer than wide, but becoming short again in the distal half, and very short toward the end of the cirrus; middle and distal joints bearing prominent dorsal spines. The cirri are from about half to two-thirds or more of the arm length.

Disk moderately or well plated; plating on the brachial and pinnule ambulacra well developed.

Ends of basal rays visible as dorso-ventrally elongate tubercles in the angles of the calyx; radials short or concealed in the median line, but always more or less visible in the angles of the calyx; when visible in the median line, with a more or less sharp median keel, and usually more or less strongly denticulate lateral (sometimes also anterior) edges; I Br_1 very short, sharply carinate; I Br_2 large, rhombic, sharply carinate; II Br and III Br (when present) 2, sharply carinate like the I Br.

Arms 10 to 21, strongly compressed and sharply carinate throughout their whole length, the median distal edge of the brachials being prominent, produced into a long overlapping spine in the outer half of the arms.

P_1 longer than P_2, though not especially enlarged; following pinnules shorter, with the basal joints less carinate; distal pinnules as long as, or rather longer than, P_1.

Color.—Bright yellow, sometimes more or less banded or blotched with white; cirri lighter in color than the arms.

Distribution.—Ki Islands northward to Japan.

Depth.—80 to 142, possibly to 152 fathoms.

The species referable to this genus are:

Stenometra conifera (Hartlaub)
" *diadema* (A. H. Clark)
" *hana* (A. H. Clark)
" *quinquecostata* (P. H. Carpenter).

15. **Stiremetra** gen. nov.

Genotype.—*Antedon acutiradia* P. H. Carpenter, 1888.

Centro-dorsal hemispherical or bluntly conical, the dorsal pole more or less papillose; cirrus sockets in one or two rows, and in two columns in each radial area, though the columns are not especially marked off.

Cirri xv–xxv, 40–50, cirrus joints proximally longer than broad, but becoming very short in the distal half, the joints in the distal two-thirds at least, sometimes all of the joints, bearing prominent dorsal spines.

Radials concealed; I Br_1 very short, band-like, deeply incised in the median line; I Br_2 large, rhombic or shield-shaped, with a strong posterior projection incising the I Br_1, and a strong median keel.

Arms 10; first two brachials sharply carinate, but following brachials rounded dorsally; in the distal two-thirds of the arm the brachials developing prominent median overlapping spines, though not appearing to be much compressed laterally. The I Br and lower brachials are in close apposition and are sharply flattened laterally.

P_1 much larger than P_2, with large lower joints which are rather strongly carinate.

Color (in spirits).—"Light brownish-white."

Distribution.—Kermadec Islands and Port Jackson, to Fiji.

Depth.—630 to 1350 fathoms.

The included species are:

Stiremetra acutiradia (P. H. Carpenter)
" *breviradia* (P. H. Carpenter)
" *spinicirra* (P. H. Carpenter).

16. **Parametra** gen. nov.

Genotype.—*Antedon orion* A. H. Clark, 1907.

Centro-dorsal hemispherical or thick-discoidal, moderate or rather small, the marginal cirri arranged in one or two rows, and approximately in two or three columns in each radial area.

Cirri IX–XXV, 15–27, up to the fifth to the seventh joint rounded, stout, smooth, and with a dull surface, then becoming laterally compressed, polished, and bearing low dorsal spines; cirri only one-sixth or one-seventh of the arm length.

Disk scantily to moderately plated; ambulacra well plated.

Radials concealed; I Br_1 short, three or more times as broad as long; I Br_2 low-triangular or widely rhombic, twice as broad as long in the median line; II Br 2, but the full series rarely developed.

Arms 10 to 20; first brachial short, slightly wedge-shaped; second larger, irregularly quadrate, much broader than long; following brachials to the tenth or twelfth oblong or slightly wedge-shaped, over twice as broad as long, then becoming triangular or very obliquely wedge-shaped much broader than long, gradually increasing in length, though remaining very oblique distally. The I Br, II Br, and proximal part of the arms are very deep, evenly rounded dorsally, compressed laterally; but the division series and arms are not in lateral apposition; the depth of the brachials gradually decreases distally. The dorsal surface of the arms may be quite smooth, or there may be a faint trace of carination basally, gradually increasing distally, so that the terminal portion of the arms is strongly compressed and strongly carinate, the brachials with forward-projecting overlapping spines.

P_1 the longest, but not especially stout, scarcely larger than P_2, though somewhat more carinate basally; following pinnules decreasing gradually in length to P_4 or P_6, which is about two-thirds the length of P_1, with nine to twelve joints which are rather broad; distal pinnules slightly longer than P_1.

Color.—Bright lemon yellow to cadmium orange, the dull portion of the cirri green, the polished light yellow; sometimes the arms may be grayish, yellow distally.

Distribution.—Ki and Philippine Islands, northward to southern Japan and eastward to the Hawaiian Islands.

Depth.—82 to at least 192 fathoms.

The species included in this genus are:

Parametra compressa (P. H. Carpenter)
" *fisheri* (A. H. Clark)
" *orion* (A. H. Clark).

17. **Cosmiometra** gen. nov.

Genotype.—Thalassometra komachi A. H. Clark, 1908.

Centro-dorsal moderate or small, the cirrus sockets arranged in two rows, and in two or three more or less regular columns in each radial area, closely crowded or more or less separated.

Cirri XVIII–XXV, 35–60, long, moderately stout, with a well marked transition joint from the seventh to the sixteenth, proximal to which the joints are smooth, rounded in cross-section, with a dull surface, distal to which they are highly polished, flattened, and furnished with prominent dorsal spines; proximal cirrus joints (except the basal) much longer than broad, distal joints very short. The longer cirri are about one-third of the arm length.

Disk scantily or moderately plated, well plated along the ambulacra; brachial and pinnule ambulacra well plated.

Ends of the basal rays visible as tubercles in the interradial angles. Radials only visible in the angles of the calyx, sometimes entirely hidden; I Br$_1$ very short, bandlike or more or less crescentic; I Br$_2$ rhombic, over twice as broad as long; II Br 2, always present in the full series; III Br 2, developed 2, 1, 1, 2, not always present. The I Br, division series, and lower bachials are in very close apposition and very sharply flattened against each other; these joints also have the edges all around slightly everted; synarthrial tubercles broad and rounded, not prominent; I Br and division series with a low broadly rounded more or less linear tubercle on their component joints.

Arms 20 to 30, moderately deep and compressed, but rounded dorsally and never carinate; first ten brachials oblong, about twice as broad as long (the first two wedge-shaped), then triangular, broader than long, soon becoming as long as broad, and in the terminal portion of the arm wedge-shaped, and more or less elongate; the brachials have more or less prominently overlapping and finely spinous distal edges.

P$_1$ considerable longer, and stouter, than P$_2$, though not especially enlarged; following pinnules decreasing to about two-thirds the length of P$_1$, then slowly increasing in length distally, the distal pinnules being rather longer than P$_1$.

Color (in spirits).—"White with faint patches of brown here and there," to uniform dark brown.

Distribution.—Sahul Bank, north Australia, northward and northeastward to Japan and the Hawaiian Islands.

Depth.—The only records are for Hawaiian species, which were taken between 319 and 355 fathoms.

Included species:

Cosmiometra crassicirra (A. H. Clark)
" *delicata* (A. H. Clark)
" *komachi* (A. H. Clark)
" *woodmasoni* (Bell).*

I am unable to properly place the following species belonging to this sub-family, because of a lack of material upon which to base comparisons, and inability to grasp the characters *in toto* from the published diagnoses.

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* It is possible that "*Antedon adriani*," which was brought back by the "Discovery," belongs to this sub-family, though there are grounds for believing it to be a member of the Tropiometridæ. The proved occurrence of either of these families so far south would be of the greatest interest in its bearing on zoogeography. Unfortunately, neither the diagnosis nor the figure (which differ radically from each other) affords any clue to the family, generic, or specific relationships of the form; it is certain, however, that it can not have much in common with *Heliometra glacialis*, with which it is compared; it does not belong in the same family.

It is to be hoped that "*Antedon adriani*" will soon be adequately described and figured and that "*Promachocrinus kerguelenensis*" (*sic*) and "*Antedon australis*" will be reidentified, especially the "young" of the latter, which possibly belong to a different genus from the larger ones. Some clue should have been given as to which of the two "*Antedon australis*" described by Carpenter is meant, though the supposition is that it is the later one.

Antedon duplex P. H. Carpenter
" *flava* Kœhler
" *incerta* P. H. Carpenter
" *latipinna* P. H. Carpenter
" *lusitanica* P. H. Carpenter
" *magnicirra* Bell
" *porrecta* P. H. Carpenter
" *valida* P. H. Carpenter.

SUB-FAMILY CHARITOMETRINÆ.

KEY TO THE INCLUDED GENERA.

- a^1 I Br and lower brachials with the dorso-lateral edge produced or everted, forming a thin flange-like border.
  - b^1 I Br with the proximal dorsal edges also produced; genital pinnules greatly and abruptly expanded; I Br and brachials rounded dorsally, without ornamentation (18) *Pœcilometra.*
  - b^2 I Br with only the dorso-lateral edges produced; genital pinnules very regularly expanded, and evenly tapering; I Br and lower brachials with the dorsal surface rugose or tubercular, and with a more or less indicated rounded median line (19) *Glyptometra.*
- a^2 I Br and lower brachials with no production of the dorso-lateral edge.
  - b^1 third and fourth joint of the genital pinnules broad and nearly flat on the outer side, but the fifth joint smaller.
    - c^1 less than 12 cirrus joints; I Br and arm bases diverging at a wide angle, so that the lower part of the animal is broad and rounded (20) *Strotometra.*
    - c^2 more than 15 cirrus joints; I Br and arm bases diverging at a relatively small angle, so that the lower part of the animal appears conical (21) *Charitometra.*
  - b^2 genital pinnules evenly, and only slightly, expanded.
    - c^1 lower and middle pinnules approximately the same in length.
      - d^1 cirri large and stout, with eighteen or more joints (22) *Pachylometra.*
      - d^2 cirri weak and slender, with sixteen or less joints (23) *Chlorometra.*
    - c^2 lower pinnules over twice as long as the middle pinnules (24) *Crinometra.*

18. **Pœcilometra** A. H. Clark.

The nominal species belonging to this genus are:

Pœcilometra acœla (P. H. Carpenter) *Pœcilometra scalaris* (A. H. Clark).

19. **Glyptometra** gen. nov.

Genotype.—Antedon tuberosa P. H. Carpenter, 1888.

Centro-dorsal thick discoidal, sometimes almost columnar, the cirrus sockets in one, or one and a more or less complete second, crowded marginal rows; when in two rows, the tendency is toward a columnar, rather than an alternating arrangement.

Cirri xv–xxx, 13–21, smooth and stout, about one-sixth of the arm length; first few joints short, the remainder subequal, slightly longer than wide, to half again as long as wide; distal joints with a slight prominence of the median part of the distal dorsal edge; opposing spine small, or reduced to a tubercle, terminally situated; terminal claw about as long as the penultimate joint, stout and moderately curved.

Disk more or less completely plated; brachial and pinnule ambulacra well plated.

Ends of basal rays visible as small tubercles in the interradial angles; radials, and often more or less of the I Br$_1$, concealed; I Br$_1$, when visible, very short and band-like; I Br$_2$ very broad, rhombic, three times as broad as long; I Br and lower brachials in very close lateral apposition, and very sharply flattened, the dorso-lateral edge being everted and more or less produced into a thin flange-like border, which may persist as far as the sixteenth brachial. The I Br series and lower brachials have a rounded median dorsal tubercle or blunt keel, the remainder of the dorsal surface of the joints being coarsely and irregularly rugose or covered with moderately large tubercles; the edges of the joints, especially the I Br series and first two brachials, are usually more or less, sometimes very strongly, crenulate.

Arms 10 (one record of 11, II Br 2), the brachials after the fourth obliquely wedge-shaped, much broader than long, soon becoming triangular, about as long as broad; distal ends of brachials slightly prominent.

P$_1$ longer than P$_2$, slender, becoming flagellate distally, composed of twenty to forty short joints; P$_2$ not quite so long with fewer joints, of which the basal eight or nine are somewhat expanded laterally; following pinnules at first slightly shorter, then slowly increasing in length; basal two-thirds of the earlier pinnules much expanded, this expansion tapering gradually away distally so that the end of the pinnule is flagellate; this expansion occupies progressively less and less of the pinnule distally, and finally disappears. The distal pinnules are as long as, or slightly longer than, P$_1$.

Color (in life).—Yellow, large specimens becoming brown.

Distribution.—Philippine Islands northward and northeastward to southern Japan and the Hawaiian Islands.

Depth.—319 to 451 fathoms.

Included species:

Glyptometra lata (A. H. Clark) *Glyptometra lateralis* (A. H. Clark)
Glyptometra tuberosa (P. H. Carpenter).

20. **Strotometra** gen. nov.

Genotype.—*Antedon hepburniana* A. H. Clark, 1907.

Centro-dorsal low-hemispherical or discoidal, with a rather large roughened dorsal pole; cirrus sockets marginal, in a single row.

Cirri x–xv, 10–15, short and stout, one-seventh to one-sixth of the arm length, the component joints (except the basal two) subequal, squarish, or slightly longer than wide; no dorsal spines; opposing spine very small, terminally situated.

Ends of basal rays visible as small interradial tubercles; radials slightly visible, or concealed; I Br_1 short, band-like, in lateral contact, and laterally flattened; I Br_2 broad, rhombic, three times as broad as long, with a low blunt median keel; I Br and first four or five brachials laterally flattened.

Arms 10; lower brachials oblong, the first two with a blunt median keel, becoming wedge-shaped, about twice as broad as long, or rather broader, after the fifth, soon becoming very oblique or triangular, about as long as broad, and rather longer in the distal portion of the arm. The brachials all have rather prominent distal edges.

P_1 slender, evenly tapering, with ten to fifteen short squarish joints; P_2 similar, or rather shorter, with about six joints, of which the third and fourth are much expanded; following pinnules similar to the last; distally the pinnules are moderately slender, somewhat longer than P_1.

Color.—Bright yellow.

Distribution.—Ki Islands, northward to the Korean Straits.

Depth.—100 to 140 fathoms.

Included species:

Strotometra hepburniana (A. H. Clark)
" *parvipinna* (P. H. Carpenter).

21. **Charitometra** A. H. Clark.

The species belonging to this genus as restricted are:

Charitometra basicurva (P. H. Carpenter)
" *incisa* (P. H. Carpenter).

22. **Pachylometra** gen. nov.

Genotype.—*Antedon distincta* P. H. Carpenter, 1888.

Centro-dorsal a thick disk or a truncated hemisphere, the cirrus sockets arranged in two closely crowded rows, and in usually fairly definite columns, three columns to each radial area; the central column, however, may be wholly or partially absent.

Cirri XX–L (usually XX–XXX), 18–25, large and stout, the component joints subequal, though slightly shorter in the distal portion, where the cirrus is slightly compressed; the most proximal joints are, of course, short; dorsal spines not developed, but the dorsal edge of the distal joints sometimes more or less carinate, and the dorsal distal ends sometimes slightly prominent; opposing spine small, tubercular, or absent; terminal claw about as long as the penultimate joint, stout, moderately curved.

Disk usually fairly completely plated, rarely scantily plated; ambulacra well plated.

Ends of basal rays usually visible as small tubercles in the angles of the calyx; radials concealed, or at most slightly visible in the angles of the calyx over the ends of the basal rays; I Br_1 very short, band-like or crescentic, deeply incised by a rounded posterior process from the I Br_2, which rises usually to more or less of a broad rounded tubercle; I Br_2 rhombic, more than twice as broad as long, the rounded posterior angle more or less produced, incising the first costals; II Br usually 4 (3 + 4), more rarely 2; generally both types occur in every specimen, but the former in the majority; III Br, when present, 2 (1 + 2), developed interiorly in 1, 2, 2, 1 order. The I Br, further division series, and lower brachials are in close apposition, and are sharply flattened laterally; they are somewhat convex dorsally, and occasionally so much so as to expose the distal edge of P_D.

Arms 10 to 33, but usually 20 or over, rounded dorsally, and laterally compressed in the proximal third; first twelve or fourteen brachials oblong, about twice as broad as long, then becoming triangular, nearly as long as broad, and in the terminal portion of the arm obliquely wedge-shaped and longer than broad.

P_D and P_1 slender, composed of twenty to forty short joints; P_2 about the same size, with slightly larger joints; following pinnules with larger joints, some of which are laterally expanded to protect the genital glands; this expansion is never excessive, and is often slight; it is always regular and even, beginning gradually and dying away more gradually toward the distal portion of the pinnule, which last is always delicate. The pinnule following P_1 may remain of the same length as P_1 for some time, may increase slightly in length, or there may be a slight decrease to P_3, after which they increase again; the distal pinnules are comparatively short, not exceeding P_1 in length, and usually somewhat shorter.

Color.—Clear yellow to brownish yellow or yellow-brown; calyx and arm bases to the first syzygy often much darker than the rest of the animal.

Distribution.—East London, South Africa, eastward through the Indian Ocean to the Sahul Bank, the Meangis, Kermadec, and Ki Islands, northward to the Philippines and Japan.

Depth.—140 to 630 fathoms; most commonly found below 300 fathoms.*

Included species:

Pachylometra angusticalyx (P. H. Carpenter)
" *distincta* (P. H. Carpenter)
" *flexilis* (P. H. Carpenter)
" *inæqualis* (P. H. Carpenter)
" *patula* (P. H. Carpenter)
" *robusta* (P. H. Carpenter)
" *sclateri* (Bell)
" *smithi* (A. H. Clark).

23. **Chlorometra** gen. nov.

Genotype.—*Antedon garrettiana* A. H. Clark, 1907.

Centro-dorsal subconical, moderate or small, the cirrus sockets in one or two more or less definite columns in each radial area.

Cirri xv, 16–18, nearly one-third of the arm length; first three joints short, the remainder about one-third longer than broad, remarkably uniform; later joints somewhat carinate dorsally; opposing spine very small, terminally situated.

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*One species is doubtfully recorded from near Kandavu, Fiji, in 255, 610, or 210 fathoms, and from the same locality in 1350 fathoms; the first is too uncertain to be depended upon, the second is so much deeper than the lowest unquestionable record that further evidence is needed before it can be accepted.

Ends of basal rays concealed or more or less prominent in the interradial angles; radials visible all around, moderately long; I Br short and broad, in close apposition and sharply flattened laterally, with low elongated median tubercles on each joint; II Br 2, rarely present; first nine or ten brachials short, discoidal or wedge-shaped, over twice as broad as long, then becoming obliquely wedge-shaped or triangular, as long as broad, gradually becoming wedge-shaped again and longer than broad distally. The lower discoidal brachials have a slightly indicated blunt dorsal keel, the remainder have rather prominent distal ends.

P_1 longer than P_2, slender, with about twenty approximately square joints; following pinnules somewhat stouter, gradually decreasing in length, then gradually increasing again distally to the length of P_1. The genital pinnules are slender, with no expansion of the joints.

Color.—Light yellow, or yellowish white, slightly tinged with brownish.

Distribution.—Meangis Islands, northward to Korea.

Depth.—95 to 500 fathoms.

Included species:

Chlorometra aculeata (P. H. Carpenter)
" *garrettiana* (A. H. Clark).

24. **Crinometra** gen. nov.

Genotype.—*Comatula brevipinna* Pourtalès, 1868.

This genus is the Caribbean representative of *Pachylometra*, with which it agrees in most of its characters. The arms are ordinarily 20 to 30, the II Br series 4 (3 + 4) or 2, some species usually all 4 (3+4) others all 2, but the majority mixed, the III Br series 2 (1 + 2) developed interiorly in 1, 2, 2, 1 order. The whole animal is robust, the calyx and arm bases large and broad, the cirri stout, as in *Pachylometra*. It differs markedly from *Pachylometra*, however, in the great length of the proximal, and shortness of the middle and distal pinnules, and in the very strong carination of the former. The pinnules decrease rapidly in length from P_1 to P_6 or P_7, the remaining pinnules being not quite half as long as P_1, the distal pinnules no longer than those in the middle of the arm; the genital pinnules are more abruptly expanded than are those of *Pachylometra*, and the brachials are more strongly overlapping, while a very strong tuberculous ornamentation is usually developed basally.

Color.—Yellow, the calyx and arm bases frequently yellow brown; large specimens are more or less brownish.

Distribution.—Gulf of Mexico, and northern part of the Caribbean Sea.

Depth.—101 to 270 fathoms.*

Included species:†

Pachylometra brevipinna (Pourtalès)
" *imbricata* (A. H. Clark).

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* According to Carpenter.

† There are also several additional undescribed species.

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PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

ELEVEN NEW MAMMALS FROM LOWER CALIFORNIA.

BY E. W. NELSON AND E. A. GOLDMAN.

Among the mammals in the Biological Survey Collection from Lower California, Mexico, are eleven undescribed species and subspecies, all except one of which were obtained by us during our visit to the Peninsula in 1905–1906. The exception—a *Bassariscus*—was collected by J. E. McLellan on San José Island in the summer of 1895.

These descriptions are published in advance of our report on the mammals of the Peninsula now in course of preparation.

Eutamias merriami meridionalis subsp. nov.

LOWER CALIFORNIA CHIPMUNK.

Type from Aguaje de San Esteban, about 25 miles northwest of San Ignacio, Lower California, Mexico (altitude about 1,200 ft.). No. 139,597, U. S. National Museum, Biological Survey Collection. ♀ adult. Collected October 5, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,268.

General characters.—Most nearly related to *E. m. obscurus* but smaller and grayer.

Color of type (slightly worn October pelage).—Top of head grizzled gray tinged with brownish and bordered by brownish line; markings on sides of head as in *obscurus*, but paler; median dorsal stripe dull rusty brownish, becoming blackish on posterior third and obsolescent on rump; middle pair of dark stripes rusty brownish, similar to anterior half of median stripe; outer pair of light stripes pale whitish gray; inner pair of light stripes darker gray; sides of body between fore and hind legs pale dingy buffy; entire rump and outer sides of hind legs pale grizzled gray, much paler than in *obscurus* and differing little from general shade of back; fore and hind feet and front of forelegs pale grayish, with slight tinge of dull buffy; top of tail blackish, washed with pale buffy gray; black on tail underlaid by a buffy basal zone; middle of underside of tail bright rusty rufous, bordered by black with an outer margin of gray.

Skull.—Distinctly smaller and slenderer than in either *merriami* or *obscurus*; zygomatic arches compressed, thus accenting general narrowness of skull; braincase much narrower and less inflated than in ***obscurus;*** bullæ smaller.

Measurements of type.—Total length, 237; tail vertebræ, 117; hind foot, 33. Skull: basilar length, 27; zygomatic breadth, 18.3; interorbital breadth, 8.5.

Ammospermophilus leucurus insularis subsp. nov.

ESPIRITU SANTO SPERMOPHILE.

Type from Espiritu Santo Island, Lower California, Mexico. No. 146,783, U. S. National Museum, Biological Survey Collection. ♀ adult. Collected February 7, 1906, by E. W. Nelson and E. A. Goldman. Original number 19,072.

General characters.—Similar to *leucurus* but larger, and underside of tail grizzled with black.

Color (fresh winter pelage).—Top of head, back, and upper part of sides grizzled brownish fawn color with a white stripe along each side of back as in *leucurus;* back of neck and middle of shoulders paler and more grayish than rest of upperparts; shoulders and outside of hind legs dull fawn color much less suffused with vinaceous than in *peninsulæ;* underparts including lower cheeks, sides of neck and flanks, dull whitish; upperside of tail blackish thinly mixed with dull white; underside dull whitish usually more or less strongly grizzled with black and with a black border.

Skull.—Larger than that of *leucurus* or *peninsulæ;* rostrum broader and heavier, and frontal area, including base of rostrum, fuller and more arched; bullæ proportionately smaller.

Measurements of type.—Total length, 232; tail vertebræ, 77; hind foot, 36. Skull: basilar length, 32.6; zygomatic breadth, 24.6; interorbital breadth, 10.5.

Thomomys magdalenæ sp. nov.

MAGDALENA ISLAND POCKET GOPHER.

Type from Magdalena Island, Lower California, Mexico. No. 146,832, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected December 3, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,743.

General characters.—Most closely related to *T. b. anitæ* of adjacent mainland but much paler, more buffy; skull larger, more massive and much more angular. Closely resembling *russeolus* in color, but skull very different.

Color (rather worn pelage).—Upperparts pale, slightly ochraceous, buffy; underparts, including lips, dull creamy white; feet and tail thinly covered with whitish hairs.

Skull.—Similar in size to that of typical *bottæ* but much more massive; rostrum shorter and heavier; ascending branches of premaxillæ broader; zygomatic arches much narrower posteriorly (not strongly bowed outward as in *bottæ*), sides less nearly parallel; interorbital region broader; braincase more elongated, narrower, more squarely truncated posteriorly, lambdoid crest less sinuous; bullæ larger. Compared with that of ***anitæ,*** larger, heavier; zygomatic arches more strongly divergent anteriorly; braincase more elongated; palate with posterior median extension thinner; palatopterygoids broader; molar series heavier; incisors more decurved—not projecting forward beyond tip of nasals as in *russeolus*.

Measurements of type.—Total length, 255; tail vertebræ, 87; hind foot, 36. Skull: basilar length, 38.4; zygomatic breadth, 29.1; alveolar length of upper molar series, 8.9.

Thomomys bottæ russeolus subsp. nov.

SAN ANGEL POCKET GOPHER.

Type from San Angel, 30 miles west of San Ignacio, Lower California, Mexico. No. 139,920, U. S. National Museum, Biological Survey Collection. ♂ young adult. Collected October 15, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,355.

General characters.—Color as in *magdalenæ*, much paler than in either *anitæ* or *nigricans*; skull smaller, lighter, less angular than in *anitæ*, with bullæ more fully rounded and basioccipital more constricted.

Color (rather worn pelage).—Upperparts pale ochraceous buffy much like *magdalenæ*; underparts dull creamy white, varying to pale buff across belly; feet and tail thinly clothed with whitish hairs.

Skull.—Much like that of *anitæ*, but smaller, lighter, less angular; bullæ more rounded; basioccipital narrower; incisors smaller; compared with *nigricans* skull smaller, with shorter rostrum; bullæ more rounded; basioccipital more constricted, less triangular or wedge-shaped, sides more nearly parallel.

Measurements of type.—Total length, 208; tail vertebræ, 73; hind foot (dry skin), 29.5.

Vulpes macrotis devius subsp. nov.

PENINSULA DESERT FOX.

Type from Llano de Yrais, opposite Magdalena Island, Lower California, Mexico. No. 147,078, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected December 13, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,771.

General characters.—Similar to *macrotis* but distinguishable by much darker, usually blackish, sides of nose, and sides of under jaws in front (sometimes including entire chin); pelage shorter; tail smaller and slenderer.

Color (fresh pelage).—Upperparts silvery gray; forehead and cheeks buffy grayish; outer sides of legs, collar on underside of neck, and posterior base of ears deep ochraceous buff, deepest or most intense on hind legs; sides of neck, belly, underside of tail and sides of body along flanks between fore and hind legs varying from deep buff to pale ochraceous buff; throat, inguinal region and usually median line of belly white; ears, except at posterior base, buffy brown; feet buffy whitish above; ochraceous buffy below; lips, sides of muzzle (sometimes chin) and tip of tail blackish.

Skull.—About equal in size to that of *macrotis* but rostrum broader and heavier; nasals broader, tapering more abruptly posteriorly; frontals less prolonged anteriorly between nasals and maxillæ; coronoid process narrower.

Measurements of type (ad. ♂).—Total length, 785; tail vertebræ, 285; hind foot, 129.

Bassariscus astutus palmarius subsp. nov.

PALM GROVE BASSARISK.

Type from Comondu, Lower California, Mexico (altitude 700 feet). No. 146,192, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected November 8, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,500.

General characters.—Most like *saxicola* but slightly darker; facial markings clearer and more strongly contrasted, usually blackish or dark iron gray and clear white; skull relatively narrower; differs from *raptor* in smaller size, grayer color, much shorter fur and slenderer tail.

Color (fresh fall pelage).—Top of head and back grayish drab slightly suffused with buff and darkened by a slight wash of black on tips of long hairs; sides suffused with buff or pinkish buff, clearest along sides of abdomen; legs dull buffy, paling to creamy buff on feet; lips, anterior part of cheeks, and narrow area extending upward behind and over eyes whitish; size of muzzle, orbital rings and posterior cheeks blackish; ears brownish on posterior base and grayish toward tip.

Skull.—Similar to that of *raptor* but smaller; fourth upper premolar narrower; bullæ more rounded; size about as in *saxicola* but zygomata less widely spreading; fourth upper premolar narrower; interpterygoid fossa narrower. Compared with *insulicola* interpterygoid fossa shorter and narrower, ending anteriorly near posterior plane of last molars (ending anterior to this in *insulicola*); bullæ more inflated.

Measurements of type.—Total length, 730; tail vertebræ, 367; hind foot, 72.

Bassariscus astutus insulicola subsp. nov.

SAN JOSÉ ISLAND BASSARISK.

Type from San José Island, Lower California, Mexico. No. 79,034, U. S. National Museum, Biological Survey Collection. ♀ adult. Collected August 7, 1895, by J. E. McLellan. Original number 1461.

General characters.—Closely related to *saxicola* and *palmarius* but color more ochraceous than either; the most yellowish of all the subspecies.

Color (worn summer pelage).—Upperparts dull drab suffused with dull ochraceous buffy, becoming darkest on top of neck and shoulders; and shading thence into pale dull buffy on underparts; tops of feet pale buffy; head grayer than body with poorly contrasted whitish and gray face markings as in *saxicola*.

Skull.—Zygomatic arches broad as in *saxicola*, but bullæ smaller and less inflated; interpterygoid fossa longer and narrower, reaching farther anteriorly between last molars; fourth upper premolar narrower and less riangular in outline owing to weaker development of internal lobe.

Compared with *palmarius* interpterygoid fossa longer, reaching further forward between last molars, and bullæ less inflated. The skull differs from that of *raptor* in slightly smaller size, with interpterygoid fossa usually narrower and reaching further forward; fourth upper premolar narrower and bullæ less inflated.

Measurements of type.—Total length, 715; tail vertebræ, 362; hind foot, 70.

Sorex lagunæ sp. nov.

LAGUNA MOUNTAIN SHREW.

Type from La Laguna, Sierra Laguna, Lower California, Mexico (5,500 ft.). No. 147,119, U. S. National Museum, Biological Survey Collection. ♀ adult. Collected January 29, 1906, by E. W. Nelson and E. A. Goldman. Original number 19,036.

General characters.—Similar in size to *S. ornatus* but underparts dark grayish brown instead of silvery grayish; tail dusky, nearly unicolor (in *ornatus* bicolor); feet darker.

Color of type (fresh pelage).—Upperparts nearly uniform dark grayish brown, browner than *ornatus;* underparts brownish, only slightly paler than back; feet dusky, darker than in *ornatus;* tail blackish, under side slightly paler than upper.

Skull of type.—Generally similar to that of *ornatus* but upper outline of braincase higher arched, or rising more abruptly from base of rostrum and more inflated, bringing highest point farther forward; molariform teeth slightly narrower, third unicuspid smaller.

Measurements of type.—Total length, 98; tail vertebræ, 41; hind foot, 12.5. Skull: breadth of braincase, 7.8; post-palatal length, 7.5; interorbital breadth, 3.5.

Sorex californicus juncensis subsp. nov.

TULE SHREW.

Type from Socorro, 15 miles south of San Quintin, Lower California, Mexico. No. 139,594, U. S. National Museum, Biological Survey Collection. ♀ (?) young adult. Collected September 1, 1905, by E. W. Nelson and E. A. Goldman. Original number 17,916.

General characters.—Size small; most like *californicus,* but tail slightly longer; feet darker; underparts tinged with dull brownish (grayish in *californicus*); braincase higher, narrower, less flattened.

Color (rather worn pelage).—Upperparts dull smoky brown mixed with grayish; underparts plumbeous overlaid with dull brownish gray; tail bicolor, dusky above, grayish below, becoming darker near tip.

Skull.—Similar to that of *californicus,* but braincase narrower, higher (more arched on upper outline); third unicuspid very small, as in *californicus.*

Measurements of type.—Total length, 101; tail vertebræ, 41; hind foot, 12.5. Skull: greatest length (condyle to front of incisors), 16.2; basion to gnathion, 13.9; breadth of braincase, 7.5; post-palatal length, 7.2; interorbital breadth, 3.5.

Myotis capitaneus sp. nov.

SAN JORGE BAT.

Type from San Jorge, 30 miles southwest of Comondu, Lower California, Mexico (altitude 100 feet). No. 146,046, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected November 12, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,526.

General characters.—Externally much like *M. californicus*, but slightly larger with ears shorter, more rounded; tragus shorter, more abruptly tapering, without distinct notch above lobe at posterior base; foot larger; skull more like *M. nigricans*, but rostrum still shorter, and braincase much larger, more inflated.

Color.—Fur of upperparts rich brownish cinnamon, becoming paler on head; underparts pale ochraceous buffy, tinged with brownish; muzzle dusky.

Skull.—Somewhat like that of *M. nigricans*, but shorter and broader; rostrum decidedly shorter; braincase much larger, more inflated anteriorly, arching more abruptly from rostrum; interorbital region broader; upper molars proportionately shorter and broader; crown of third upper premolar decidedly broader than long.

Measurements.—Total length, 92; tail vertebræ, 42; forearm (dry skin), 33.6; tibia (dry skin), 18.9; foot (dry skin), 7.4; thumb (dry skin), 5.8; height of ear (dry skin), 9.1. Skull: condylobasal length, 12.2; breadth of braincase, 6.9; depth of braincase, 5.1; maxillary toothrow, 4.5.

Myotis micronyx sp. nov.

COMONDU LONG-EARED BAT.

Type from Comondu, Lower California, Mexico (altitude 700 feet). No. 146,044, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected November 8, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,490.

General characters.—Much like *M. evotis*, but slightly smaller, with proportionately much smaller ears, thumb and claws; braincase more inflated anteriorly; free borders of interfemoral membrane indistinctly ciliate as in *evotis*.

Color.—Fur of upperparts, including middle of face, light golden cinnamon; sides of face thinly covered with dusky hairs; underparts gray, slightly tinged with buff.

Skull.—Similar to *evotis*, but narrower; braincase higher, more inflated anteriorly, arching more abruptly from rostrum; palate narrower behind molars; bullæ smaller. From that of *milleri* the skull differs in the same characters as from *evotis*.

Measurements.—Total length, 90; tail vertebræ, 42; forearm (dry skin), 35.8; tibia (dry skin), 18.2; foot (dry skin), 7.9; thumb (dry skin), 5.7; height of ear (dry skin), 14.6. Skull: condylobasal length, 14.5; zygomatic breadth, 14.3; breadth of braincase, 7.2; depth of braincase, 5.3; maxillary toothrow, 6.2.

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PROCEEDINGS

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NOTES ON SOME RARE OR NOT WELL-KNOWN COSTA RICAN BIRDS.

BY OUTRAM BANGS.

From December, 1907, to June, 1908, C. F. Underwood was in the field collecting birds in Costa Rica; all the material gathered during this time came to me. Many rare species, and some new to Costa Rica, were secured, and in the following notes I list those that are of special interest.

The principal places worked by Underwood on this trip were the Volcán de Tenorio and the Cerro Sta. Maria, northwestern Costa Rica; La Vijagua in the eastern water shed of the same general range of mountains, toward the Nicaraguan boundary; Bolson, in the lagoon region of the north Pacific faunal area of Costa Rica; and Coralillo, Buenos Aires, and El General, all in the Pacific faunal area.

Rostrhamus sociabilis (Vieill.).

One female everglade kite was taken at Bolson December 28, 1907. The bird is of rare occurrence in Costa Rica, and this specimen is the first I have been able to get from that country.

Aramides cajanea (Müll.).

One young female, about one-third grown, in nestling plumage and without wing feathers, was secured at El General June 19, 1908. In color it differs but little from adults, having rufous underparts and a gray neck, the gray color somewhat obscured by tufts of reddish-brown down. It proves conclusively that the wood rails of this section of the genus do not pass through a gray juvenile plumage.

Leptotila plumbeiceps Scl. & Salv.

Two adult males of this dove were taken at Bolson, one December 18, the other December 29, 1907. This is, I believe, the farthest south that the species has been traced and the first Costa Rican record. *Leptotila* *verreauxi* Bonap. also was taken in large series at Bolson, the two species thus occurring together at this point.

Leptotila cassini vinaceiventris (Ridg.)

Many specimens referable to this form were secured at Tenorio, Cerro Sta. Maria and La Vijagua. *Leptotila cassini vinaceiventris* is exactly intermediate in characters as well as in geographic position, between *L. cassini cassini* Lawr. of Panama and Veragua and *L. cassini cerviniventris* (Scl. & Salv.) of Guatemala and British Honduras.

Geotrygon albiventer Lawr.

Two fine adults of this rare dove, so very uncommon in other parts of Costa Rica or in Panama, were taken on Tonorio February 10, 1908.

Geotrygon lawrencii Salv.

Two specimens of Lawrence's quail dove were secured on Tonorio, thus extending the range of the species to the northern boundaries of Costa Rica.

Geotrygon chiriquensis Scl.

The capture of a male of this species in Cerro Sta. Maria January 9, 1908, extends its range somewhat to the north of previous records, well toward the Nicaraguan frontier.

Neomorphus salvini Scl.

Salvin's ground cuckoo is so seldom taken by bird collectors that two examples secured by Underwood, one at La Vijagua February 14, the other in the Cerro Sta. Maria January 9, 1908, are worthy of record.

Trogon underwoodi Bangs.

Six males and one female were taken on Tenorio and in the Cerro Sta. Maria in January and February, 1908. With the exception of one male which comes very close to the most deeply colored example of *T. auranteiventris* from Chirîqui, this series runs very uniform and quite like the type from Miravalles. The females of the two forms are not very different, and perhaps *T. underwoodi*, in spite of the peculiar distribution of these trogons, had better be considered a northern subspecies of *T. auranteiventris* than a distinct species.

Trogon melanocephalus illaetabilis subsp. nov.

Type from Bolson, Costa Rica. No. 22,781, collection of E. A. & O. Bangs. ♂ adult. Collected December 25, 1907, by C. F. Underwood.

Characters.—Similar to true *T. melanocephalus* from eastern Mexico south through Yucatan, eastern Guatemala and Honduras to eastern Nicaragua, except that adult male has head, throat and chest dark gray-slate color to blackish slate, instead of black; the adult ♀ with these parts and the back and scapulars also, much paler and grayer than in true *T. melanocephalus*. Size averaging slightly larger and the bill slightly heavier.

MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Tarsus.	Exposed Culmen.
22,781	♂ ad.	C. R. Bolson . .	143	134	15	21.5
22,782	♂ ad.	do . .	144	137	14.5	20
22,783	♂ ad.	do . .	146.5	141.5	14	22
22,784	♂ ad.	do . .	144	142.5	14.5	22
22,785	♂ ad.	do . .	142	142.5	14	24
22,786	♂ ad.	do .	142	144	15	23.5
22,804	♂ ad.	C. R. Tenorio .	145	136	14	24
16,583	♂ ad.	C. R. Bebedero	143	142	14	21
22,795	♀ ad.	C. R. Bolson . .	141	137	13.5	21
22,796	♀ ad.	do . .	143	137.5	14	21.5
22,797	♀ ad.	do . .	141	131	14.5	21
22,798	♀ ad.	do . .	142	137	14.5	22
22,799	♀ ad.	do . .	140	132	14	22.5
22,800	♀ ad.	do . .	139	141	13.5	21
22,801	♀ ad.	do . .	141	144	14	22
22,802	♀ ad.	do . .	144	142	14	22.5

For comparison with these a series of *Trogon melanocephalus melanocephalus* Gould affords the following measurements:

No.	Sex.	Locality.	Wing.	Tail.	Tarsus.	Exposed Culmen.
2248	♂ ad.	Mex. V.C. Pasa Nueva	139	143	14	20
2249	♂ ad.	do	138	140	14	20.5
15,275	♂ ad.	Yuc. San Filipe . . .	135	141	13.5	19
15,276	♂ ad.	do . . .	136.5	137	14	21
10,296	♂ ad.	Honduras, Ceiba . .	131	139.5	14.5	20
10,298	♂ ad.	do . .	131	133	14.5	20.5
10,300	♂ ad.	do . .	138.5	143.5	13.5	21
2250	♀ ad.	Mex. V.C. Pasa Nueva	133	134	14.5	20
15,892	♀ ad.	Yucatan	136	136	14.5	19
10,295	♀ ad.	Honduras, Ceiba . .	135	133	14	19
10,299	♀ ad.	do . .	133	137	13.5	19
10,301	♀ ad.	do . .	132.5	137.5	13.5	20.5

***Remarks.**—Trogon melanocephalus illaetabilis* is found in Costa Rica only in the northwestern to north central parts of the country. Specimens from western Nicaragua appear to be quite the same as those from Costa Rica, and the form is distinguished from true *T. melanocephalus* of the eastern slopes of Central America from southern Mexico to eastern Nicaragua chiefly by its grayer head and chest, and by being a trifle larger. In both subspecies young birds have grayer or paler heads and necks than do adults. The young are easily told by the markings of the tail feathers and wings, and should of course not be compared with adults. The young of the two subspecies, however, when compared are nearly as different one from the other as are the old birds.

Prionornis carinatus (Du Bus).

As there are very few Costa Rican records for this bird, an adult male from La Vijagua March 3, 1908, is worthy of mention. At the same place Underwood also took examples of *Prionornis minor* Hartert.

Hylomanes momotula Licht.

Twelve specimens were secured at La Vijagua, Tenorio and Cerro Sta. Maria during January and February, 1908. Upon comparing these skins with an equal number from Mexico, Guatemala, and British Honduras, I fail to find any constant differences.

Glaucidium griseiceps Sharpe.

One adult male, La Vijagua, February 25, 1908. Although Sharpe in his Hand List of Birds gives the range of this owl as extending south to Panama, this is, so far as I know, the first actual record of its capture in Costa Rica.

Platypsaris aglaiæ latirostris (Bonap.).

At Bolson, in December, 1907, Underwood took two adult males, two young males and an adult female of the gray becard. The two old males are nearly alike; each has an ill-defined, small, pinkish-white throat patch. The subspecies, which is a very strongly characterized one, is rare in collections and there are but few Costa Rican records.

Scotothorus veræpacis (Scl.).

In the last few years I have accumulated a very large series of this species from Costa Rica, which proves conclusively that the supposed southern form, my *Scotothorus veræ-pacis dumicola*, was based wholly on differences due to individual variation, and that such a form does not really exist. Any large series from any one place, whether within the limits of the Pacific fauna or the Caribbean fauna, is found to contain specimens exactly like the northern true *veræ-pacis*, others representing the so-called *dumicola* and others again variously intermediate.

Piprites griseiceps Salv.

Two specimens, male and female, were taken at La Vijagua February 19 and March 1, 1908. The bird still remains so rare that I mention these two additional examples, especially as they are from a locality from which the species has not before been recorded.

Rhynchocyclus marginatus Lawr.

At La Vijagua, Underwood took two adult females of this very distinct and exceedingly rare tyrant bird, one on February 21, the other February 25, 1908. These two specimens agree in color (except in having the yellow of belly and wing-margins paler, and therefore more like the type from Panama) with the only other known Costa Rican skin, an adult male from Corrillo in my collection. They afford the following measurements:

No.	Sex.	Wing.	Tail.	Tarsus.	Exposed Culmen.
22,151	♀ ad.	59.5	46	16	11.5
22,152	♀ ad.	60.5	47	16.5	12

These, as will be seen, by comparison of Ridgway's[*] measurements of the type, male, and co-type, female, from Lion Hill Station, Panama, are very similar, and while my Corrillo specimen differs somewhat, I believe the Costa Rican and Panaman specimens referable to one form.

Camptostoma imberbe Scl.

The beardless flycatcher has a more southward range than has been supposed, as proved by a small series taken lately by Underwood in northern Costa Rica, as follows: Tenorio, ♂, January 23, 1908; ♀, February 7, 1908; Coralillo, ♀, April 6, 1908; Bolson, ♂, December 10, 1907, ♀, December 17, 1907. At the latter place, Bolson, he also took *Camptostoma pusillum flaviventre* (Scl. & Salv.), the ranges of the two species thus meeting in western Costa Rica.

Pipromorpha assimilis (Scl.).

In Birds of North and Middle America, Ridgway says that all Costa Rican specimens examined by him were intermediate between *P. assimilis assimilis* and *P. assimilis dyscola*. While this is absolutely true, especially as regards measurements, there is nevertheless such a conspicuous difference in color between series of skins from the north Caribbean fauna on the one hand and the south Pacific fauna on the other, that I think a better plan is to include both forms in the Costa Rican ornis. Skins from such points (in the Caribbean fauna) as Carrillo, Tenorio and La Vijagua, though smaller, are in color very similar to or often quite the same as specimens from Mexico to Honduras, representing true *Pipromorpha assimilis* (Scl.), and may safely be called by that name.

Examples from the Boruca region of southwestern Costa Rica are very nearly, both in size and color, typical *P. assimilis dyscola* (Bangs), and from thence northward at least to Pozo Azul and Buenos Aires all specimens can be referred to this form.

Myiophobus fasciatus furfurosus (Thayer & Bangs).

This Panaman species lately added to the Costa Rican ornis by Carriker, who took it at Buenos Aires de Terraba,[†] appears to be of such rare occurrence in Costa Rica that one young female in nestling plumage secured by Underwood at El General June 13, 1908, is worthy of record. This example differs from adults from Panama only in being a little more reddish-brown both above and below and in lacking the yellow crown-patch.

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[*] Birds of North and Middle America, Part IV, pp. 392, 393, 1907.

[†] Annals of the Carnegie Museum, Vol. IV, p. 302, 1908.

Myiarchus nuttingi nuttingi Ridg.

Myiarchus brachyurus Ridg.

In Birds of North and Middle America, Ridgway expressed a doubt as to the distinctness of these two tyrant birds, and gave *brachyurus* subspecific rank. I find, however, that my thirty specimens from northern and western Costa Rica fall without an intergrade, when compared by measurements, into two series, one a large bird with a heavy bill (*brachyurus*); the other a small bird with a small, slender bill (*nuttingi*). Correlated with this marked difference in size is a slight though constant difference in color, which in skins taken in December, January and February is quite appreciable. In faded specimens I fancy it would not be so easily detected; the smaller bird (*nuttingi*) being brighter yellow below, and browner, less grayish olive above.

As the range of these two tyrants is coincident over a very large area, they can not be geographical races of one species, and as they certainly seem distinct I believe Nelson's arrangement in his revision of the North American Mainland Species of *Myiarchus** the correct one. Here Nelson considered *Myiarchus brachyurus* specifically distinct from *M. nuttingi* and *M. inquietus*, a northern subspecies of *nuttingi*.

Henicorhina prostheleuca (Scl.).

The case of the white-breasted wood wrens is another instance of a large amount of material (my series now numbers two hundred skins) proving that two races instead of one should be credited to Costa Rica.

Specimens from Carrillo, La Vijagua, Tenorio and Cerro Sta. Maria are all referable to *H. prostheleuca prostheleuca* Scl., some of them somewhat intermediate, but very many absolutely indistinguishable from Mexican examples. Skins from any point in southwestern Costa Rica belong, of course, to *H. prostheleuca pittieri* (Cherrie). The two subspecies are easily told apart, one of the best characters being the color of the median crown-stripe.

Microcerculus.

On his last collecting trip Underwood took examples of the nightingale wren in Costa Rica as follows:

El General (Pacific fauna), four fully adult males, June and July; La Vijagua (Caribbean fauna), one young male, one nearly fully adult female, February; Cerro Sta. Maria (mostly but not wholly Pacific fauna), two males and one female, all immature, January; Tenorio (mostly but not wholly Pacific fauna), two young females, February.

These with three skins from Boquete, on the Volcán de Chiriqui, collected by Brown (upon which I founded my *M. acentetus*), gives me a series of fourteen skins from Costa Rica and Chiriqui, that perplexes me much, and causes me to doubt the existence in Central America of but one form. For the help of any other ornithologist who may be fortunate enough to secure a better series still of this elusive little ventriloquous inhabitant of the deep forest I shall discuss the specimens pretty fully.

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* Proc. Biol. Soc. Wash., XVII, pp. 21-50, March 10, 1904.

Three forms are supposed to occupy Central America as follows:

Microcerculus philomela Salv. Guatemala. Larger; less rufescent brown.

M. daulias Ridg. Eastern Costa Rica. Smaller; more rufescent brown.

M. luscinia Salv. Panama to southwestern Costa Rica. Smaller; with underparts darker and much more uniform.

The slight differences in size claimed for the various races do not appear to hold—one male from El General, which should belong to *M. luscinia*, supposedly the smallest race, has the wing 61.5, larger than in *M. daulias*, considered to be the largest race.

As to color, immature examples, that is those with dusky vermiculations above, and with the underparts varied with V-shaped paler markings and with slight dusky bars on flanks, vary *very much* from one locality. Two skins from Cerro Sta. Maria have whitish throats in marked contrast to the color of the rest of the underparts; another from the same place has the throat dark grayish brown, not very different from the color of the breast and belly. One of the skins with a white throat has all the feathers of the chest, breast and belly broadly edged with grayish-white and whitish V-shaped marking lower down on the same feathers. The other white-throated one lacks the white edges to these feathers, but has the pale V-shaped markings. The third, with a grayish-brown throat, has no whitish markings below, but has the feathers of the breast and belly with dark grayish V-shaped markings.

Two from Tenorio and one from La Vijagua are very similar to the third just described from Cerro Sta. Maria. The female from La Vijagua, which is in nearly fully adult plumage, is, however, very different, and is hardly distinguishable in any way from the specimens from Chiriqui, and I should unhesitatingly call it *M. luscinia*. It differs only in having some slight traces of dusky vermientations above and indistinct dusky bands on the flanks—both probably last remnants of immaturity.

Lastly the three fully adult specimens from the Volcán de Chiriqui, taken in March and April, and the four adults from El General, southwestern Costa Rica, in June and July, are all alike, except that the El General skins are slightly paler, grayer brown on breasts and bellies, and slightly more rufescent on flanks, differences doubtless due to season, especially as neither series runs perfectly constant in this respect, and one skin from Chiriqui (the palest) practically matches one (the darkest) from El General.

It thus appears to me that three facts, at least, are obvious enough:

(1.) Differences of size in Central America specimens of *Microcerculus* are not great enough or constant enough to be of diagnostic value.

(2.) Specimens in immature plumage from one locality show a wide range of variation in color and markings (possibly due to age of the individual, it requiring more than one month to attain the adult plumage).

(3.) Specimens in adult plumage, or nearly so, are subject to a slight seasonal variation in color, but apart from this can not satisfactorily be distinguished from such remote places lying in such different general faunal areas as northeastern Costa Rica on the one hand and southwestern Costa Rica and Chiriqui on the other.

Vireolanius pulchellus viridiceps Ridg.

At El General (Pacific fauna) on June 20, 1908, Underwood took an adult male and female of this well-marked form.

Vireolanius pulchellus verticalis Ridg.

Two specimens, adult male and female, were secured by Underwood at La Vijagua (Caribbean fauna) on February 24 and 25, 1908. These two races are beautifully distinct, and as the shrike-vireo is one of the really very rare Costa Rican birds, the records of additional localities are worth making.

Hirundo erythrogastra Bodd.

In the latter part of May, 1908, barn swallows were abundant at Buenos Aires, and Underwood took a small series of specimens between the 23d and 26th. The birds were apparently not breeding, but were belated migrants. The late dates at which many other North American species still linger in Costa Rica was a revelation to me as I began to receive collections from that country, and I am still at a loss to account for it.

Wilsonia pusilla pusilla (Wils.).

Three specimens, all referable to this sub-species, were taken—one female on Tonorio February 1, 1908, two males in the Cerro Sta. Maria January 4 and 8, 1908—by Underwood last winter. The identification is positive; I myself felt sure of it, but to be doubly certain submitted the skins to Ridgway, who confirmed my opinion. The bird in winter plumage can be told from *W. pusilla pileolata* not only by its duller coloration, but by its smaller size, especially shorter wing. This record extends the southward range of the form in winter by a considerable distance, southern Mexico being, I believe, the farthest south it had previously been taken on the continent. *W. pusilla pileolata* (Pallas) is very abundant in winter, especially at higher elevations in southern and central Costa Rica and Chirfqui, and remains till late in May. It was not, however, found by Underwood in northern Costa Rica during his last year's work.

Basileuterus rufifrons mesochrysus (Scl.).

A large series taken at Buenos Aires and El General, both places within the south-Pacific faunal area of Costa Rica, in May, June and July, represents this form apparently in its extreme, the specimens being quite indistinguishable from examples from Colombia and Panama. I also find that skins from the Boruca region of Costa Rica, formerly referred to *B. rufifrons delattrii* (Bonap.) by me,* belong here.

Basileuterus rufifrons delattrii (Bonap.) was also taken in large series on Tenorio and in the Cerro Sta. Maria, and this form appears to occupy all eastern and northern Costa Rica, from the vicinity of San José northward and eastward.

The two sub-species are easily distinguished by well-marked differences in color, and by the much longer tail of *B. rufifrons delattrii*. At the time I published the paper referred to I had no skins of this latter form.

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* Auk, Vol. XXIV, p.. 306, July, 1907.

Euphonia gnatho (Cabanis).

After very careful study of all available material I am convinced that all Costa Rican birds (some of which have been called *Euphonia hirundinacea* Bonap.) are in reality referable to *Euphonia gnatho,* and that that species is an excellent one. I am glad to be able to state that Ridgway now thoroughly agrees to this.

The bill, though it varies much individually in size, is always larger, sometimes very much larger in *E. gnatho* than in *E. hirundinacea* and always different in shape. The female is much yellower below than the female of *E. hirundinacea,* though this varies individually somewhat, the extreme being reached in the female described by Ridgway* from Pigres. The male is always metallic greenish-blue above, in place of the metallic dark blue of *E. hirundinacea,* the difference being very striking on comparison of series.

Though *E. gnatho* does not appear to be a very common species, I now have a fairly large series, including both sexes, from various parts of Costa Rica, and from the Caribbean as well as the Pacific areas.

Phoenicothraupis alfaroana Ridg.

On Tenorio and in the Cerro Sta. Maria this recently described ant tanager was quite abundant, and a series of fifty-four specimens was taken in January and February, 1908. Considerable individual variation in both sexes is presented by this series, and many skins are much darker in color than any among the original specimens from Miravalles. Some examples, in fact, come very close to *P. rubica nelsoni* of Yucatan, and I am rather inclined to the belief that the form is really the palest race of *rubica,* and its relationship to *P. rubra* of South America is more distant.

Chlorothraupis carmioli (Lawr.).

At La Vijagua in February, 1908, Underwood found Carmiol's tanager in large numbers and took upwards of sixty specimens. Some dozen individuals in this series are extensively, but irregularly, marked about the head, throat, scapulars and sides of the breast with dull vermilion, and others are slightly so marked. The red markings are not due to extraneous staining, but to red pigment in the feather itself. Both sexes show this red mottling and I am unable to account for it unless it be reversion to some ancestral bright-colored bird, like *Piranga,* which the irregular nature of the markings rather suggest.

Aimophila rufescens hypæthrus subsp. nov.

Type from Cerro Sta. Maria, northern Costa Rica. No. 21,606, collection of E. A. and O. Bangs. ♂ adult, collected January 4, 1908, by C. F. Underwood.

Characters.—A well-marked geographic race, nearest to *Aimophila rufescens rufescens* Swains, of southern Mexico and Guatemala, but rather smaller, with the bill actually larger; whole upperparts distinctly darker; lateral crown stripes much more dusky; dusky shaft stripes on back and scapulars much broader and more conspicuous. From *A. rufescens discolor* Ridg. of the coastal regions of Honduras and British Honduras the new form differs much, being larger, much darker above, and much less grayish on sides of head, breast and flanks.

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* Proc. Biol. Soc. Wash., Vol. XVIII, Oct. 17, 1905, pp. 225-226.

MEASUREMENTS.

No.	Sex.	Locality.	Wing.	Tail.	Tarsus.	Exposed culmen.
21,606	♂	Cerro Sta. Maria	75	78	25.5	18
21,605	♂	do	72	74	26	17.5
21,601	♂	do	75	78.5	26	17
21,602	♂	do	73	74	25	17
21,607	♂	do	77	78	26	18
21,608	♂	Tenorio	73.5	74	26	17.5
21,603	♀	Cerro Sta. Maria	69	—	24.5	17
21,604	♀	do	71	75	25	16.5

Remarks—Late explorations have shown that this russet-tailed ground sparrow is a not uncommon resident of the mountains of northern Costa Rica, and on his last trip Underwood took specimens on Tenorio and in the Cerro Sta. Maria. On comparing these with the two forms which are geographically nearest I found the Costa Rican bird to be very different from either. Nelson, to whom I showed the specimens, also agrees as to its distinctness, and it remains but to give it a name.

Amaurospiza concolor Cabanis.

Three specimens from Tenorio, an adult male killed January 26, and a pair, adult male and female, January 25, 1908. The female is uniform tawny-brown above and on sides, and slightly paler and more cinnamoneous on throat and middle of belly. So far as I know this is the first female of the species that has been taken.

Sporophila minuta minuta (Linn.).

Carriker lately recorded a single immature male taken by himself at Buenos Aires, the first Costa Rican example of the species. When Underwood visited Buenos Aires in May, 1908, he found *Sporophila minuta* abundant, but wholly confined to the open savanna and exceedingly shy. He collected a series of twenty specimens which includes adults of both sexes and immature males.

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PROCEEDINGS
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TWO NEW AUSTRALIAN CRINOIDS.

BY AUSTIN HOBART CLARK.

The collections made by the German steamship *Gazelle* in the Australian seas included a number of unstalked crinoids taken on the zoologically little known coast of West Australia.

Through the courtesy of Drs. W. Weltner and R. Hartmeyer of the Königliche Zoölogisches Museum at Berlin, and of Dr. Th. Studer of Berne, these crinoids have been submitted to me for study. There are among them two interesting new species, both belonging to characteristic littoral East Indian genera.

Ptilometra dorcadis sp. nov.

Antedon macronema 1889. STUDER, Die Forschungsreise S. M. S. *Gazelle*, III Thiel, p. 185.

Type.—Cat. No. 2,964 (part), Königliche Zoölogisches Museum, Berlin.

Centro-dorsal columnar, 6.5 mm. in diameter at the base by 3 mm. long, the sides slightly convex, the large polar area flat, 5 mm. in diameter; cirrus sockets closely crowded, arranged in fifteen columns of two or three each, the sockets in each column tending to alternate with those in the neighboring columns.

Cirri xxxv, 93, 55 mm. to 60 mm. long, stout basally, but tapering distally; first joint very short, about four times as broad as long, the following gradually increasing in length to about the eighth to thirteenth, which is squarish, then remaining similar or becoming very slightly longer than broad, until about the thirty-fifth, then very gradually decreasing in length, the terminal forty or so being about twice as broad as long; proximal joints smooth, without dorsal or ventral spines; at about the thirty-fifth the median distal dorsal border begins to become prominent, this feature gradually becoming more pronounced, resulting in dorsal spines on the later joints resembling those of *P. macronema;* opposing spine large, prominent, blunt, directed anteriorly, arising from the entire dorsal surface of the penultimate joint, equal in length to the anterior diameter of that joint; terminal claw nearly as long as the two preceding joints, slender, slightly curved.

Disk and brachial ambulacra naked; covering and side plates well developed in the distal half of the pinnule ambulacra.

Ends of the basal rays visible as rhombic tubercles in the angles of the calyx, but not projecting above the general surface of the radials; radials rather prominent, nearly four times as broad as long, gently concave anteriorly; I Br_1 about twice and one-half as broad as long, the straight lateral edges in apposition; I Br_2 (axillary) rhombic, about twice as broad as long, the lateral edges about one-half as long as those of the I Br_1; II Br 2, in the type developed on the right side of three of the I Br series, on both sides of one of the I Br series, but absent from the fifth I Br series. Division series and first two brachials exteriorly with a uniformly produced narrow border, by which they are in lateral apposition, though they are not laterally flattened.

Arms 15 in number (in the type) about 55 mm. long; brachials in general as in *P. macronema*, but sharply rounded dorsally in the distal half of the arm instead of sharply carinate, the long overlapping spines of that species being represented by insignificant tubercles on the median part of the distal edge of each joint. Syzygies occur between the third and fourth brachials, again between the twelfth and thirteenth or thirteenth and fourteenth, and distally at intervals of five to seven (usually six or seven) oblique muscular articulations.

P_1 8 mm. long, stiff, rather small, with nine joints, the first not quite so long as broad, the second slightly longer than broad, the third twice as long as its proximal diameter, the remainder greatly elongated, except for the minute terminal joint; P_2 12 mm. long, much stouter than P_1, with nine joints, similar in proportion to those of P_1; P_3 the longest on the arm, 13 mm. or 14 mm. long, with eleven joints, of similar proportions to those of the two preceding pinnules; P_4 11 mm. long (intermediate in length between P_1 and P_2), with eleven or twelve joints, the first twice as broad as long, the second squarish, the following gradually increasing in length, becoming greatly elongated distally; succeeding pinnules similar to about the middle of the arm, then becoming more slender, slightly less stiff, and decreasing in length distally to about 9 mm. P_1 is occasionally absent, in which case P_2 is much smaller than usual.

Color (in spirits).—Dull purple.

Type locality.—Turtle Bay anchorage, north coast of Dirk Hartog Island, west Australia; 7 fathoms.

Remarks.—*Ptilometra dorcadis* is very easily distinguished from *P. macronema* of the eastern coast of Australia by the very long cirri which are much stouter basally, the proportionately much greater length of the lower pinnules which are longer than, instead of shorter than, the distal, and especially by the large size of P_3 and the elongation of the joints in all the pinnules, these never being so long as wide in *P. macronema*, even distally. The absence of dorsal carination and of overlapping spines on the brachials gives the arms a somewhat different appearance. Its remarkably robust aspect differentiates it from *P. macronema* in about the same degree that that species is differentiated from *P. trichopoda* and *P. pulcherrima* of the Philippine Islands.

The type of *P. macronema* was taken at King George's Haven, in southwest Australia, while all the very numerous specimens I have examined are from the eastern coast, mostly from Port Jackson or Sydney; there is therefore a possibility that the present species will turn out to be the true *macronema*, in which case the form from Sydney would require a new name and might appropriately be known as *Ptilometra mülleri*.

Oligometra studeri sp. nov.

Type.—Cat. No. 2,964 (part), Königliche Zoölogisches Museum, Berlin.

Centro-dorsal thin, discoidal, the bare polar area flat; cirrus sockets arranged in a single marginal row.

Cirri xii, 16–18, 7 mm. long; first joint very short, the following gradually increasing in length to the sixth or seventh, which, with the remainder, is squarish; on the third or fourth a low transverse ridge, subterminal in position, is developed; this gradually moves, in three or four joints, to a median position, at the same time gaining slightly in height; distally this ridge progressively decreases in width, and on the last four joints before the penultimate becomes a low median spine. The ridges on all the joints appear as low spines in lateral view. Opposing spine median in position, arising from the entire dorsal surface of the penultimate joint, in height equal to about half the diameter of that joint, much longer than the short spines on the preceding joints; terminal claw rather stout, slightly longer than the penultimate joint, abruptly curved basally, but becoming more nearly straight distally.

Ends of the basal rays not visible; radials concealed in the median line, but visible in the angles of the calyx; i Br_1 oblong, short, about four times as broad as long, the lateral edges straight; i Br_2 (axillary) broadly pentagonal, almost triangular, about twice as broad as long; synarthrial tubercles slightly developed.

Arms 10, 45 mm. long; first two brachials wedge-shaped, slightly over twice as broad as the exterior length, the first interiorly united for rather more than the proximal half, diverging at an obtuse angle distally; third and fourth brachials (syzygial pair) slightly longer interiorly than exteriorly, about twice as broad as the median length; following three brachials oblong, about three times as broad as long, then becoming obliquely wedge-shaped, and after the twelfth triangular, slightly broader than long, and in the terminal part of the arm wedge-shaped, about as long as broad. After the tenth the brachials develop rather prominent and slightly overlapping distal ends, but this character gradually dies away after about the middle of the arms. Syzygies occur between the third and fourth brachials, again between the ninth and tenth, and fourteenth and fifteenth (the former sometimes omitted), and distally at intervals of four to seven (usually five) oblique muscular articulations.

P_1 about 4.5 mm. long, slender, evenly tapering and becoming flagellate in the distal portion, with about sixteen joints, the first two rather over twice as broad as long, the third nearly as long as broad, the following gradually increasing in length, being about twice as long as broad distally; P_2 6 mm. long, stouter and stiffer than P_1, being, in fact, the largest and longest pinnule on the arm, with about eighteen joints, the first two approximately twice as broad as long, the third squarish, the remainder about half again as long as broad; the pinnule is smooth, the joints being without lateral processes or everted ends; P_3 3 mm. long, small and weak, nearly as large basally as P_1, but tapering more rapidly, with thirteen joints, the first short, the following increasing in length to the fourth, which is squarish, and further increasing to a length of about twice the breadth in the terminal portion; following pinnules similar, soon becoming more slender and gradually increasing in length; distal pinnules very slender and hair-like, about 7 mm. long, with twenty-three joints, the first short and crescentic, the second nearly as long as broad, slightly less in diameter anteriorly than posteriorly, the third squarish, the remainder about half again as long as broad, becoming about twice as long as broad in the distal portion.

Color (in spirits).—Brownish-purple, the cirri and dorsal surface lighter.

Type locality.—Dirk Hartog Island, west Australia; 7 fathoms.

Remarks.—This new form is readily distinguishable from the ten previously described species of the genus; the elongate P_1 of *O. bidens*, as well as the two dorsal processes on its cirrus joints, the very numerous cirrus joints of *O. gracilicirra*, the short stout cirrus joints of *O. pinniformis*, the single dorsal spine on the few stout cirrus joints of *O. caribbea*, the strong imbrication of the brachials of *O. imbricata*, and the spines or lateral processes on the proximal pinnules of *O. gracilicirra*, *O. carpenteri*, *O. japonica*, *O. pulchella* and *O. serripinna* separate them at once. The elongate proximal pinnules described in *O. adeonæ* would serve to differentiate it, if *adeonæ* should be shown to really belong to the genus *Oligometra*.

Oligometra studeri is most closely related to the group of species typified by *O. serripinna*.

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PROCEEDINGS
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TWO NEW BATS FROM THE SOUTHWESTERN UNITED STATES.

BY N. HOLLISTER.

In the Biological Survey collection are two undescribed species of *Myotis*, represented by specimens from near Needles, California, and the mountains of New Mexico. Both are interesting from the fact that they exhibit a tendency toward the crowding out of the middle upper premolar, an unusual condition in this genus. Six out of the eight skulls examined lack this particular tooth. The specimens were collected during the course of field work for the Biological Survey.

Myotis occultus sp. nov.

Type from west side of Colorado River ten miles above Needles, California. No. 137,098 U. S. National Museum, Biological Survey Collection. ♂ adult, skin and skull. May 14, 1905. N. Hollister. Original No. 2237.

General characters.—Nearest to *M. peninsularis* but smaller; forearm shorter; ears smaller; tragus shorter with blunt tip. Calcar longer than free border of interfemoral membrane, which is nearly naked; wing from near base of toes.

Color.—Back rich glossy brown, nearest to Prout's brown of Ridgway but with a cinnamon tint; face and underparts much paler with decided buffy cast; ears and membranes brown.

Skull.—Nearest to *M. peninsularis* but smaller; braincase much flatter; rostrum flat and wide. Differs also from all other North American species of *Myotis* in its low, flat braincase and relatively wide, flat rostrum. One of the two specimens, the type, lacks the middle upper premolar of *Myotis* as heretofore diagnosed, leaving the normal dentition of the species somewhat in doubt.

Measurements of type.—Total length, 96; tail vertebræ, 40; foot, 10.5; tibia, 14; thumb, 6; tragus, 6.5. Skull: Condylobasal length, 14.2; zygomatic breadth, 9.5; breadth of braincase, 7.8; interorbital constriction, 4; maxillary toothrow, 5.9.

Remarks.—Only two specimens of this bat are at hand. They were shot in the dense cottonwood bottomlands of the Colorado River May 14 and 15, 1905. The topotype is preserved in alcohol.

Myotis baileyi sp. nov.

Type from base of White Mountains (7,500 ft.) near Ruidoso, New Mexico. No. 125,787 U. S. National Museum, Biological Survey Collection. ♀ adult, in alcohol. September 10, 1902. N. Hollister. Original No. 195.

General characters.—Nearest to *M. velifer* but smaller; forearm shorter; tragus very broad at base and sharply pointed; calcar about equal to free border of interfemoral membrane, which is thinly haired; wing from base of toes. Larger than either *peninsularis* or *occultus*, with larger ears and skull.

Color.—Back sepia; underparts smoke gray; face blackish; ears and membranes black.

Skull.—Like that of *M. velifer* but smaller, with lower, flatter braincase. Compared with *peninsularis* it is larger; braincase proportionately lower with straighter sides. Much larger than in *occultus* and higher posteriorly. Five out of the six known specimens, including the type, lack the middle upper premolar; teeth otherwise essentially as in *velifer.*

Measurements of type.—Forearm, 40.3; tibia, 17.9; foot, 9.1; ear, 14.9; tragus, 6.5; thumb, 6.4. Skull: Condylobasal length, 16.1; zygomatic breadth, 10; breadth of braincase, 7.8; interorbital constriction, 4.1; maxillary toothrow, 6.1.

Remarks.—Besides three specimens from the type locality, only three others have come to light; these were collected by Vernon Bailey and Clarence Birdseye at Luna, Gila National Forest, New Mexico, September 6 and 7, 1908.

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DESCRIPTION OF A NEW BAT FROM NICKAJACK CAVE, TENNESSEE.

BY ARTHUR H. HOWELL.

The presence of a colony of bats in Nickajack Cave was reported by Mr. W. P. Hay in an article on the crustacean fauna of the cave, published in 1903.[*] Two specimens in alcohol were forwarded by him to the National Museum, where they were referred provisionally to *Myotis velifer*. In order to secure a series of skins of these bats, I visited the cave on August 31, 1908. Penetrating for a distance of about 300 yards from the entrance, numbers of bats were seen in the dim light of a torch, flying about the large room.[†] In a few minutes I discovered a cluster of bats, apparently as large as a man's head, hanging from the ceiling of the cave. Discharging one barrel of my shot-gun at them, large numbers fell to the ground and the rest took wing. I picked up about 70 as the result of this shot, and many wounded ones escaped by swimming away in the stream which flows through the cave. At the entrance to the cave bats were heard squeaking in the crevices in the ceiling, and a few additional specimens were secured by shooting into the crevices. I was informed by persons living in the vicinity that at dusk the bats may be seen coming out of the cave in immense numbers. They also stated that the bats sometimes cling in clusters to the sides of the cave, where they may be picked off by hand. All the specimens taken here were of one species, which, on comparison with other species of *Myotis*, proves to be new. It may be characterized as follows:

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[*] Proc. U. S. Nat. Mus. XXV, p. 418, 1903.

[†] Mr. Hay, in his description of the cave (l. c., pp. 417-419) gives the dimensions of this room as "100 feet wide and long, and 60 feet high"; the size of the entrance is given as "200 feet wide and 75 feet high."

Myotis grisescens sp. nov.

GRAY BAT.

Myotis velifer Miller, N. Am. Fauna, No. 13, p. 59, 1897 (in part; specimens from Marble Cave, Mo.); Hahn, Proc. U. S. Nat. Mus. XXXV, p. 580, 1908 (Indiana).

Type from Nickajack Cave, near Shellmound, Marion County, Tennessee. No. 157,517 U. S. National Museum, Biological Survey Collection. ♂ adult, skin and skull. August 31, 1908. A. H. Howell. Original number, 1233.

General characters.—Nearest to *Myotis velifer*, but differing from it in darker color, smaller skull, weaker dentition, and in the point of attachment of the wing membranes to the feet.

Color.—Varying above from dark hair-brown to dark mouse-gray, the hairs concolor to the roots; below mouse-gray basally, pale smoke-gray at tips; flanks and posterior border of abdomen paler, the hairs whitish and concolor; ears, feet, and membranes black.

Skull and teeth.—Compared with *M. velifer*, the skull of *grisescens* shows the following differences: Rostrum shorter and narrower; frontal region markedly depressed; parietal region rising more abruptly from the rostrum, thus giving to the skull a "pug-nosed" appearance; zygomata more widely expanded; dentition weaker, the upper canines and third upper premolars decidedly smaller; first and second upper molars with hypocone slightly developed (absent in *velifer*).

External characters.—The feet are large, as in *velifer*; the ears are only a trifle shorter than those of *velifer* and the tragus is about the same length as in that species. The wings are attached to the feet close to the ankle joint, not at base of toes as in *velifer*.

Measurements.—Average of 10 topotypes: Total length, 93;* tail vertebræ, 37.5;* extent, 282;* tibia, 17.5; foot, 10.5; forearm, 41.6; longest finger, 70; ear from meatus, 14.5; tragus, 8.8. Skull: Greatest length, 15.9 (15.5–16.3); condylo-basal length, 14.9 (14.7–15.1); zygomatic breadth, 9.9 (9.6–10.2); breadth of braincase, 8.2 (8–8.4); length of upper toothrow (exclusive of incisors), 5.9 (5.8–6.1); length of mandible, 11.6 (11.3–11.8).

Geographic distribution.—Specimens have been examined as follows:

Tennessee: Nickajack Cave, 83 (21 skins).
Missouri: Marble Cave, Stone County, 3 (alcoholics).
Indiana: Mitchell, 1 (skin).†

Remarks.—This species, though agreeing rather closely with *Myotis velifer* in size, differs from it widely in color, and indeed is quite unlike any other North American bat in this respect. It is the largest member of the genus occurring in the eastern United States and is equaled only by *M. velifer*, *M. incautus*, and *M. thysanodes* of the southwestern States.

Three specimens in alcohol from Marble Cave, Missouri, have been in the Biological Survey for some years, but have always been referred to

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* Measured in the flesh; other measurements from alcoholics.

† Collection of the University of Indiana; kindly loaned by Dr. C. H. Eigenmann.

M. velifer. Upon re-examining these, they are found to agree with the species here described in cranial characters and in the attachment of the wing membranes to the feet. The color of course is not known, as no skins from this cave are available. A specimen (skin and skull) from Mitchell, Indiana, agrees with *grisescens* in skull characters, but differs slightly from it in color, though much nearer to this species than to *velifer*. It is sepia above, with a russet tinge; below, hair-brown.

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A NEW THRUSH FROM MEXICO.

BY E. W. NELSON.

Catharus mexicanus is one of the rarest of Mexican birds in collections and until recently was unknown north of Jalapa, Veracruz, the type locality. It was therefore with much interest that I had the opportunity a short time since to examine a fine specimen collected by Austin Paul Smith in the Sierra Madre of Tamaulipas, far north of any previous record. The mountains of Tamaulipas are in a much less humid region than the type locality of *mexicanus* and Mr. Smith's specimen differed so much from a topotype of that form collected by Mr. Frank Chapman that I suspected the Tamaulipas bird represented an undescribed subspecies. Recently Mr. Outram Bangs has received two additional specimens from Tamaulipas, one from Galindo and the other from Rampahuala, which prove the validity of the new form. I take pleasure in naming it in honor of Mr. Austin Paul Smith who has generously presented the type to the Biological Survey Collection.

Catharus mexicanus smithi subsp. nov.

SMITH NIGHTINGALE THRUSH.

Type from Carricitos (altitude 6,000 feet) in Sierra Madre of the East, about 50 miles northwest of Victoria, Tamaulipas, Mexico. No. 204,801 U. S. National Museum, Biological Survey Collection. ♂ adult. Collected October 16, 1908, by Austin Paul Smith.

Geographic distribution.—Wooded east slope (mainly in canyons) of Sierra Madre of the East, in State of Tamaulipas; probably extends north and south respectively into States of Nuevo Leon and San Luis Potosi.

Subspecific characters.—Similar to typical *mexicanus* from Jalapa but black of crown clearer or less smoky; upperparts including top of wings and tail clearer green—less suffused with olive; underparts with a distinctly greenish shade on gray of breast and flanks; upper mandible dusky or blackish; feet and tarsii pale dusky; wings and tail shorter, and tarsus longer, than in *mexicanus.* The measurements given below are from an adult topotype of *mexicanus* (sex unknown) in the collection of the American Museum of Natural History and from the type of *smithi*:

C. mexicanus: wing, 95; tail, 70; tarsus, 31.5; culmen, broken.
C. m. smithi: " 89; " 65; " 33; " 14.

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THE STATUS OF *SOREX MERRIAMI*, WITH DESCRIPTION OF AN ALLIED NEW SPECIES FROM UTAH.

BY WILFRED H. OSGOOD.

Some twenty-five years ago, Maj. Chas. E. Bendire collected a small shrew near Fort Custer, Montana. The specimen, preserved in alcohol, subsequently passed into the hands of Dr. G. E. Dobson, who cited it in 1890 as the type of his *Sorex merriami*. Owing to a chain of circumstances, suspicion then arose that Dr. Dobson had accidentally associated a skull of some Old World shrew with the alcoholic specimen from Montana, and the name *merriami*, though retained in most systematic works, has since been somewhat in abeyance. The case was stated by Dr. Merriam, in 1895, as follows:*

"The type and only known specimen of this remarkable shrew was presented to me by Maj. Charles E. Bendire, who collected it at the post garden, on the Little Big Horn River, about a mile and a half above Fort Custer, Mont., December 26, 1884. I sent it, with all my other shrews, to Dr. George E. Dobson, who was then engaged on a monographic revision of the Soricidæ. Unfortunately, owing to Dr. Dobson's continued ill health, all that has ever been published of this monograph is a fasciculus of plates, showing the jaws and teeth of certain species, with a page of explanation facing each plate. (Monog. Insectivora, Part III, fasc. 1, May, 1890.) The present species is named and its peculiar dentition shown in Pl. XXIII, fig. 6, of this work. But the remarkable shape of the palate and peculiarities of the skull as a whole are not shown. The skull was removed from the alcoholic specimen by Dr. Dobson, and I have sometimes wondered whether by any possible accident it could have been transposed with that of some Asiatic species, it is so very unlike all known American shrews. When the specimen was returned the alcoholic bore my original label and number (1001), but the skull was numbered differently (1886; its proper number is 4861). Dr. Dobson afterwards wrote me that his number was an error, and that the skull belonged to my alcoholic No. 1001.''

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* North American Fauna, No. 10, pp. [illegible], Dec. 31, 1895.

Since this account no further light upon the unfortunate case was obtained until the summer of 1908, at which time, while engaged in field work in southern Utah for the Biological Survey, I had the good fortune to secure a shrew closely resembling the type of *S. merriami*. This appears to remove all doubt as to the validity of *merriami* as an American species and to make it practically certain that Dr. Dobson's type was as he supposed, both skin and skull from Fort Custer, Montana.

The Utah specimen agrees with *merriami* in its most pronounced characters, as dentition, shortness of palate, and thickness of rostrum, but differs sufficiently in size and depth of braincase to warrant separate recognition. Externally, it differs from all other American shrews in its pale color, particularly its creamy white underparts and white feet. These characters are more or less evident in the alcoholic type of *merriami*, and it is not improbable that in both species they are correlated with a relatively arid habitat. The Utah specimen was caught about two hundred yards from running water on a dry rocky Upper Sonoran slope, where the vegetation was scant and practically restricted to *Juniperus*, *Artemisia*, and *Atriplex*.

Sorex leucogenys sp. nov.

Type from the mouth of the canyon of Beaver River, about 3 miles east of Beaver, Beaver Co., Utah. No. 157,952 U. S. National Museum, Biological Survey Collection. ♀ ad. Aug. 12, 1908. W. H. Osgood.

Characters.—Similar to *Sorex merriami*, but slightly larger, with a deeper, more elevated braincase. Tail decidedly shorter than head and body; color pale; skull with thick heavy rostrum and short broad palate; third unicuspid slightly larger than fourth.

Color.—Upperparts pale brownish drab; lower sides slightly paler than back, with distinct traces of clear ecru drab; underparts pure creamy white, the light terminal parts of the hairs relatively broad and almost entirely subduing the plumbeous undercolor; hairs of chin and sides of face from just below the eye to the end of the nose pure creamy ite to roots; whiskers white, except a few upper ones blackish at the eet white; tail brownish drab above, white at extreme tip, and w.

Skull and teeth.—Much as in *Sorex merriami*, but slightly larger; braincase decidedly deeper, not abruptly elevated, but sloping gradually upward in the plane from the anterior nares to the supraoccipital; palate broad and sub-triangular, with scarcely any deflection of its boundaries between the unicuspid and the molariform series; second unicuspid largest; third decidedly larger than fourth, its apex slightly inclined backward; fifth unicuspid unpigmented, small, wide and antero-posteriorly compressed; first four unicuspids relatively high and laterally compressed, lacking an inner lateral cusplet or pigmented ridge from apex to cingulum (in this respect, agreeing closely with *S. richardsoni*); inferior cusps of middle upper incisors small; first mandibular incisor with inferior cusps much reduced, scarcely more than slight undulations; third lower incisor rather high and narrow, with its posterior secondary cusp reduced.

Measurements.—Type: Total length, 107; tail vertebrae, 38; hind foot, 12.5. Skull: Greatest length, 17.2; greatest breadth of braincase, 8.4; interorbital breadth, 3.7; length of bony palate, 7; postpalatal length, 7.5; greatest width between outer sides of last upper molars, 5.2; length of maxillary toothrow, 7.4.

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Stanford University Library
APR 29 1909

NOTES ON THE DISTRIBUTION OF CERTAIN MAMMALS IN THE SOUTHEASTERN UNITED STATES.

BY ARTHUR H. HOWELL.

In mapping the distribution of mammals in the southeastern States, particularly Georgia, Alabama and Mississippi, the Biological Survey has been handicapped by the lack of information on the ranges of many of the species. Parts of peninsular Florida and the coast region of Georgia have been examined and a full list of the mammals published by Outram Bangs.[*] Portions of Tennessee have been studied by Samuel N. Rhoads, who has published an important contribution to the mammalogy of that State.[†] Considerable work has been done in North Carolina by Dr. C. Hart Merriam, the Brimley brothers, H. C. Oberholser, and others, and several brief local lists from the State have appeared.[‡] Louisiana has been fairly well covered by the field parties of the Biological Survey, though most of the records are as yet unpublished. Collections have been made by the Survey in the coast region of Mississippi, Alabama, Georgia and South Carolina, but the interior of these four States is almost a blank, so far as our knowledge of the mammals is concerned.

With the purpose of extending our knowledge of the fauna of this region and to determine the boundaries of the life zones, a survey of parts of the southeastern States was carried on by the Biological Survey during the summer and fall of 1908. Between July 2 and November 24 I visited six States and made collections at more than 30 localities. In attempting to cover such a large area in a single season, the collecting of specimens was necessarily limited and the results of course are incomplete. So many new facts in regard to mammal distribution have been ascertained, however, that it seems desirable to publish at this time the more important discoveries, leaving a complete report on the region until additional field work has been prosecuted.

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[*] Proc. Boston Soc. Nat. Hist., XXVIII, pp. 157-235, 1898.

[†] Proc. Acad. Nat. Sci. Phila., 1896, pp. 175-205.

[‡] See C. S. Brimley, "A Descriptive Catalogue of the Mammals of North Carolina, Exclusive of the Cetacea" < Journ. Elisha Mitchell Sci. Soc., XXI, pp. 1-32, 1905; H. C. Oberholser, "Notes on the Mammals and Summer Birds of Western North Carolina," 1905 (published by the Biltmore Forest School).

An examination was first made of the mountainous parts of northern Georgia. Between July 4 and July 20, the following localities were visited: Tate and Grassy Mountain (5 miles east of Jasper) in Pickens County; Ellijay and Rich Mountain in Gilmer County; and Young Harris and Brasstown Bald in Towns County. About ten days were spent in the region about Brasstown Bald, which is the highest mountain in the State (4,768 feet), and many important records were obtained there.* The greater part of northern Georgia is included in the Upper Austral Zone. Transition Zone occurs on the mountain summits above 3,500 feet and a few Canadian Zone species were found on the extreme summit of Brasstown Bald.

Work was next carried on in the Cumberland Mountain region of eastern Kentucky and southwestern Virginia, July 23–29. The localities visited were Big Stone Gap, Virginia, and Big Black Mountain, Harlan Co., Kentucky. This mountain, the highest in the State, reaches an altitude of 4,100 feet and is probably the only peak in the range carrying any considerable area of Transition Zone. Tazewell and Burkes Garden, Virginia, were visited July 30 to August 7. One of the peaks of Rich Mountain, close to Tazewell, was examined and collections made both at the base and summit (4,230 feet).

Crossing the mountains at Cumberland Gap, I made a stop (August 9–13) at Barbourville, Kentucky, in the foothills of the Cumberland Range at 1,000 feet altitude. Proceeding southward into Tennessee I examined three localities on the Cumberland Plateau, as follows: High Cliff, Campbell County (about 3 miles east of Jellico), August 20–22; Briceville and Cross Mountain, August 14–22; and the southern end of Walden Ridge in the vicinity of Rathburn Station (Soddy P. O.), August 25–29.

Cross Mountain (3,550 feet) is the highest peak in the Cumberland Range in Tennessee and supports a small area of Transition Zone above 3,000 feet. The same zone appears also at considerably lower altitudes in this range in shaded ravines having a northern exposure, as at High Cliff, along the north base of the Cumberland Escarpment, where Transition descends to about 1,000 feet altitude. Walden Ridge is a fairly level plateau varying in altitude from 1,600 to 2,400 feet, and extends from the vicinity of Chattanooga northeastward to Anderson County. It is included in the Upper Austral Zone, though a very few Transition species occur in small isolated areas in the cool gulches cut by the streams.

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*A list of the birds and a description of the faunal characteristics of this region will be found in "The Auk," XXVI, pp. 129–137, April, 1909.

Northern Alabama was next examined, and collections were made at Scottsboro (September 1–3) and Huntsville (September 4–10). Lower Austral Zone extends up the Tennessee Valley in this State as far at least as Scottsboro. A short detour was made into West Tennessee to trace out the boundaries of this zone, which reaches east to western Lawrence County. Collections were made at Lawrenceburg (September 12–15) within the Upper Austral Zone.

In northern Mississippi short stops were made at Burnsville (September 16–18), Michigan City (September 22, 23), and Holly Springs (September 21). Practically the whole of Mississippi is included in the Lower Austral Zone, as shown by the presence in the northernmost counties of swamp rabbits, and of such characteristic trees as *Quercus nigra*, *Q. lyrata*, *Nyssa aquatica*, and *Taxodium distichum*.

In central and southern Alabama collections were made at the following localities: Reform, Pickens County (September 24–27; Talladega (September 28, 29); Auburn (October 1–5); Brewton (October 7, 8); Castleberry (October 9–13); Fairhope October 16, 17); and Bon Secour (October 18–26). At the last mentioned place opportunity was afforded to visit the Gulf beach and study the peculiar fauna of that region.

A few days were spent in southeastern Louisiana, at Slidell (October 28–31) and Covington (November 2, 3), after which my work was confined to certain special investigations, first in the section of Mississippi occupied by the cotton boll weevil, and later in central Georgia, tracing out the ranges of the two swamp rabbits (*Lepus aquaticus* and *L. palustris*). The localities visited in Georgia were Abbeville (November 18), De Soto (November 19), Lumpkin (November 20, 21), Preston (November 23), and Americus (November 24).

In addition to the records made personally on this trip, and on a previous trip in northern Louisiana in January and February, 1908, I have included in this report records of specimens in the Biological Survey Collection taken by other members of the staff, and of specimens in the National Museum Collection and the private collection of Dr. C. Hart Merriam which furnish additional information on the ranges of the species in the region under consideration.

Sciurus carolinensis Gmelin.

SOUTHERN GRAY SQUIRREL.

The range of this squirrel includes nearly the whole of the southern States except southern Florida and the coast region of Louisiana. In the lowlands it is found almost exclusively in heavily-timbered swamps and in many places is still very abundant. In the mountainous districts it ranges less commonly to at least 4,500 feet altitude. It is extensively hunted in the fall and winter, and furnishes an important food supply.

The Biological Survey Collection contains a large number of specimens, all of the typical form, from various localities in the southern States, as follows:

Tennessee: Arlington, 7; Big Sandy, 17; High Cliff, Campbell County, 1.
Georgia: Brasstown Bald, Towns County (4,500 feet alt.), 1; Grassy Mountain, 5 miles east of Jasper, 1; Lumpkin, 1.
Alabama: Catherine, 1; Reform, 2; Hale County, 1; Castleberry, 3; Bon Secour, 4; Point Clear, Mobile Bay, 1.
Mississippi: Michigan City, 3; Washington, 2; Bay St. Louis, 6.
Louisiana: Mer Rouge, 3; Tallulah, 2.

Sciurus niger Linnæus.

FLORIDA FOX SQUIRREL.

The northern and western limits of the range of this squirrel are not definitely known. It probably occupies, in addition to peninsular Florida, nearly all of southern Georgia and the coast region of the Carolinas. Bangs records a specimen from Columbus, Georgia.* There are specimens in the National Museum from Nashville and Hogansville, Georgia—the former a typical specimen in the gray phase, the latter a black skin without skull. From the very scanty material now at hand, intergradation between *niger* and *texianus* can only be surmised. Intergradation does take place, however, between *niger* and *neglectus*, as shown by intermediate specimens in the National Museum from Accotink, Virginia.

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* Proc. Biol. Soc. Wash., X, p. 148, 1896.

Sciurus niger texianus Bachman.[*]

SOUTHERN FOX SQUIRREL.

Fox squirrels are becoming scarce in many parts of the South, and specimens are often difficult to obtain. A small series from the Cumberland Plateau in East Tennessee is referable to this form, though intermediate between *texianus* and *neglectus*. Of the five specimens examined, all but one have white noses. The color of the back is somewhat darker than in typical *neglectus* from Maryland, and the underparts are pale rufous instead of white. There is less black on the head than in typical *texianus*. A specimen from extreme northern Mississippi (Michigan City) also is referable to *texianus*, though probably grading toward *rufiventer*. This subspecies is thus seen to have an extensive range in the Southern States, from the lower Mississippi Valley northeastward to the Cumberland Mountains.

Specimens have been examined as follows:

Tennessee: High Cliff, Campbell County, 5.
Mississippi: Michigan City, 1.
Alabama: Castleberry, 1.

Tamias striatus (Linnæus).

CAROLINIAN CHIPMUNK.

The range of the chipmunk in the Southern States includes practically all of Tennessee, western North Carolina, northern and western Georgia, and most of Alabama and Mississippi. Loomis records the species as abundant at Mount Pinnacle, Pickens County, South Carolina,[†] and Audubon and Bachman state that it occurs rarely at Columbia, S. C., but is not found nearer the seaboard than that point.[‡] The same authors speak of it as occurring throughout Louisiana, and (on page 69) mention capturing a specimen in that State, but no other records of its occurrence there have been found. It is apparently absent from the coast region of Mississippi, Alabama and Georgia.[§]

Although reported by the residents to be numerous at many localities in the States visited, particularly in the mountainous portions, very few of the animals were actually met with. Records have been secured of their occurrence at the following localities:

Kentucky: Clover Fork, Harlan County (common; specimen taken).

Tennessee: High Cliff, Campbell County (reported); Coal Creek, Anderson County (one seen); Walden Ridge, near Soddy, Hamilton County (reported).

Georgia: Young Harris (common; three specimens); Rich Mountain, near Ellijay (one seen at 4,000 feet); Grassy Mountain, near Jasper (several seen); Atlanta (one seen in the city park); Preston (one seen, November 22).

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[*] Defined by Osgood, Proc. Biol. Soc. Wash., XX, pp. 46–47, 1907.

[†] Auk, VII, p. 33, 1890.

[‡] Quad. N. Am., I, p. 73, 1849.

[§] Dr. C. Hart Merriam has recorded (Am. Nat., XX, p. 238, 1886) a specimen from Charleston, S. C. This specimen can not now be found, and it seems likely that there is some error connected with the record.

Alabama: Huntsville (reported to occur on Monte Sano); Rebecca Mountains, ten miles south of Talladega (one specimen)*; Greensboro (five specimens); Garland (reported); Castleberry (reported).

Mississippi†: Michigan City (reported to occur about five miles southwest); Washington (two specimens); Natchez (one seen, November 15).

Marmota monax (Linnæus).

WOODCHUCK; GROUND-HOG.

The range of the woodchuck was found to extend south along the mountains into northern Georgia and Alabama. It is fairly numerous throughout the Cumberland Plateau and extends west in Tennessee at least as far as Fayetteville. It has once been recorded from western South Carolina (Mt. Pinnacle, Pickens County ‡). As stated by Audubon and Bachman, "it is not found in the maritime districts of either North or South Carolina." Records were secured of its occurrence at the following localities:

Tennessee: High Cliff, Campbell County (one specimen); Cross Mountain, Anderson County (reported common); Walden Ridge, near Soddy (common); ridge between Fayetteville and Pulaski (reported).

Georgia: Young Harris (common on the mountains up to 4,500 feet; one specimen); Grassy Mountain, ten miles east of Jasper (common).

Alabama: Monte Sano, near Huntsville (reported scarce).

Sciuropterus volans querceti Bangs.

SOUTHERN FLYING SQUIRREL.

Flying squirrels are quite generally distributed in the South. This subspecies, only slightly differentiated from typical *volans*, ranges from Florida to the Mississippi Valley and north at least to Kentucky and Tennessee. Specimens have been examined from the following localities:

Kentucky: Eubanks, 3 (collection of C. Hart Merriam); Hickman, 1.
Tennessee: Watauga Valley, 2.
South Carolina: Cleora, Edgefield County, 1.
Georgia: Young Harris, 1.
Alabama: Greensboro, 2.
Mississippi: Washington, 1; Columbus, 1 (U. S. N. M. Coll.)
Louisiana: Prairie Mer Rouge, 1 (U. S. N. M. Coll.).

Peromyscus maniculatus nubiterræ Rhoads.

CLOUDLAND WHITE-FOOTED MOUSE.

The range of this form was ascertained to extend southward along the high summits of the Blue Ridge (above 4,000 feet) into Georgia. It was taken also in Virginia. Specimens were secured from the following localities:

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* This specimen is much paler and grayer than typical *striatus* from northern Georgia and western North Carolina, and shows an approach to *T. s. griseus;* the Greensboro specimens, on the other hand, are very dark and richly colored.

† Allison reports chipmunks common in the Tennessee Valley in Tishomingo County (Auk, XXIV, p. 13, 1907).

‡ Loomis, Auk, VII, p. 33, 1890.

Virginia: Rich Mountain, near Tazewell (4,100 feet altitude), 1.
Georgia: Brasstown Bald (4,300–4,750 feet), 12.

Peromyscus polionotus subsp.*

BEACH MOUSE.

This handsome little mouse, previously known from Whitfield, Florida, was found to be common on the white sand dunes along the outer beach near Bon Secour, Alabama, where six specimens were secured. Their tracks were seen everywhere on the sand, where the little animals run about in the scattered clumps of stunted live oak bushes.

Sigmodon hispidus Say and Ord.

COTTON RAT.

This species, while mainly confined to the Lower Austral Zone, was taken on this trip in northern Georgia at the foot of the mountains (2,000 feet altitude), well within the Upper Austral. It was taken also in Tennessee for the first time.

Specimens were secured at the following localities:

Georgia: Young Harris, 3 (common).
Tennessee: Soddy (Rathburn Station), 1.
Alabama: Huntsville, 1; Auburn, 3; Bon Secour, 4.
Louisiana: Lecompte, 4.

Oryzomys palustris (Harlan).

RICE RAT.

This species has been supposed to be confined mainly to the coast region of the South Atlantic and Gulf States. It was a great surprise, therefore, when I trapped specimens at the foot of the Cumberland Mountains in eastern Kentucky and eastern Tennessee. The records now at hand indicate that it pushes into the interior along the streams well within the Upper Austral Zone. In view of these facts, there seems to be no further need to doubt the authenticity of the specimens collected by Goss at Neosho Falls, Kansas. †

The rice rats were caught in small marshes in the river bottoms, and in some cases in dry cultivated fields or in ditches along the railroad tracks. They were particularly abundant in the marshes on the coast of Alabama. Their characters are remarkably uniform over their extensive range.

Specimens are at hand from the following localities:

Kentucky: Barbourville, 3.
Tennessee: High Cliff, Campbell County, 1; Lawrenceburg, 2; Arlington, Shelby County, 1.
Alabama: Huntsville, 4; Reform, Pickens County, 1; Bon Secour, 3; Montgomery, 1; Gallion, 1; Elmore, 1.
Mississippi: Fayette, 1.

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* This new form will be described by Osgood in N. Am. Fauna, No. 28, now in press.

† See Coues, Monog. N. Am. Rodentia, p. 117, 1877; Lantz, Trans. Kans. Acad. Sci., XX, Pt. II, p. 216, 1907.

Neotoma pennsylvanica Stone.

ALLEGHENY CAVE RAT.

This species, known previously from New York to Virginia and Kentucky (Mammoth Cave), and provisionally reported from North Carolina* and Alabama,† was taken at three localities in southern Tennessee and northern Alabama, and indications of its presence were found as far south as Talladega, Alabama. No signs of them were discovered in Georgia, but the mountainous portions of the State are well suited to their habits and they will probably be found to occur locally. They were taken as high as 4,000 feet in Virginia, and as low as 800 feet in Tennessee (Lawrenceburg). It is strictly a cliff rat and is likely to be found in rocky bluffs or caves throughout the Transition and Upper Austral Zones.

Records were obtained of their occurrence at the following localities:

Virginia: Rich Mountain (at 4,000 feet) near Tazewell (abundant in crevices and caves in the cliffs at the summit; 4 specimens).

Tennessee: Walden Ridge, near Soddy (numerous signs found about rocky bluffs; 1 specimen); Lawrenceburg (abundant in bluffs along creek; 1 specimen).

Alabama: Monte Sano, east of Huntsville (common in caves on the mountain at 1,500 feet; 2 specimens); Rebecca Mountains, 10 miles south of Talladega (old signs seen about cliffs at 1,800 feet).

Evotomys carolinensis Merriam.

CAROLINA RED-BACKED MOUSE.

This handsome mouse was found to be numerous in a cool, shaded ravine in Big Stone Gap, Virginia, where three specimens were trapped July 28 and 29. Efforts were made to secure them on the mountains of northern Georgia, but although traps were set in suitable places for several nights, none was caught.

Microtus pinetorum auricularis Bailey.

BLUEGRASS VOLE.

Specimens have been received by the Biological Survey from the following localities:

Tennessee: High Cliff, Campbell County, 2; Watauga Valley, 1.

Microtus pinetorum nemoralis Bailey.

WOODLAND VOLE.

Two specimens taken at Mansfield, Louisiana, January 25, 1908, are intermediate between *auricularis* and *nemoralis*, but seem nearer to the latter form. The skulls agree with those of *nemoralis*, but the hind feet are somewhat shorter.

Fiber zibethicus (Linnæus).

MUSKRAT.

The Muskrat ranges in the South through upper South Carolina and the northern parts of Georgia, Alabama and Mississippi. As stated by

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* Rhoads, Proc. Acad. Nat. Sci., Philadelphia, 1896, p. 192.

† Rhoads, Journ. Cincinnati Soc. Nat. Hist., XIX, p. 53, 1897.

Audubon and Bachman[*] it is absent from the alluvial lands in Carolina,[†] Georgia, Alabama and Florida. Although recorded by the same authors as existing "in the mountains of Georgia, and the higher portions of Alabama," practically nothing more has been published on the range of the species in those States.[‡] The only published records from South Carolina are likewise those of Audubon and Bachman, who state that they "have obtained it from Aikin, and St. Matthew's parish, on the Congaree River, but have never found traces of it nearer the sea than seventy miles from Charleston." While in South Carolina in November, 1905, I learned of the presence of muskrats at Cleora, Edgefield County, a few miles above Aikin.

Following is a list of the localities in the Southern States where this species is known to occur:

Tennessee: High Cliff, Campbell County (common; four specimens); Watauga Valley (one specimen); Briceville (reported numerous).

Georgia: Young Harris (reported common); Hogansville (specimen in U. S. National Museum).

Alabama: Scottsboro (reported); Huntsville (reported common); Reform (scarce; one specimen).

Mississippi: Michigan City (numerous; several seen).

Fiber zibethicus rivalicius Bangs.

LOUISIANA MUSKRAT.

This form has a very restricted range in the coast region of Louisiana. They are abundant in the marshes bordering Lake Pontchartrain, but at Covington, less than ten miles north of the lake, are unknown to the people and apparently do not occur. There are no muskrats in the marshes at Bon Secour, Alabama, on the east side of Mobile Bay, nor do they occur at Castleberry, Alabama, fifty miles back from the coast. A specimen of this form taken at Slidell, Louisiana, is in the National Museum.

Lepus aquaticus Bachman.

SWAMP RABBIT.

The northward limits of the range of this rabbit mark the boundary of the Lower Austral Zone. Special efforts were made, therefore, to determine the extent of its range. It occupies practically all of Mississippi and the greater part of Alabama, pushing up the Tennessee Valley as far as Scottsboro, Alabama, and reaches as far east in Tennessee as Henryville, Lawrence County. It penetrates extreme western Georgia into Stewart and Webster Counties, and a few miles east of Preston meets the range of *L. palustris*. It is apparently absent from the immediate coast region of Alabama.

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[*] Quad. N. Am., I, p. 123, 1849.

[†] It occurs on the northern coast of North Carolina as far south at least as Hyde County, whence it has been reported by Brimley (Journ. Elisha Mitchell Sci. Soc., XXI, p. 12, March, 1905).

[‡] R. W. Smith, in a list of the birds of Kirkwood, Georgia, mentions the muskrat as occurring rarely at that place (Wilson Bull., X, p. 51, 1903).

Records were secured of its occurrence at the following localities:

Tennessee: Henryville (reported to be found sparingly at this point, probably ranging up Buffalo Creek from the Tennessee River).

Mississippi: Michigan City (abundant).

Alabama: Huntsville (common; three specimens); Scottsboro (reported scarce); Reform (abundant; five specimens); Auburn (common; six specimens); Castleberry (common; four specimens); Brewton (common).

Georgia: Lumpkin (fairly common; one specimen); Preston (reported scarce).

Louisiana: Covington (three specimens).

Lepus palustris Bachman.

EASTERN MARSH RABBIT.

The western limit of the range of this rabbit is in the vicinity of Americus, Georgia. On Kinchatoonee Creek, a few miles west of Americus, *Lepus aquaticus* is the prevailing species. *L. palustris* reaches the coast of Alabama, where it is abundant in the wet salt marshes bordering Mobile Bay. In central Georgia the same species lives under a very different environment—in the comparatively dry, open swamps which are found in the shallow depressions in the pine forests.

Specimens were secured at the following localities:

Georgia: Americus, 2; Abbeville, 5.

Alabama: Bon Secour, 2.

Lepus floridanus transitionalis Bangs.

TRANSITION COTTONTAIL.

This form, known previously from New England, New York and Pennsylvania, was taken on Brasstown Bald, in northern Georgia. A single specimen was secured, July 16, at 4,600 feet altitude, and later two specimens, taken December 6 on the lower slopes near Young Harris, were received from a collector residing there. These have been identified by E. W. Nelson.

Lepus floridanus mallurus Thomas.

EASTERN COTTONTAIL.

This form occupies eastern and southern Georgia and reaches Alabama in the Mobile Bay region. Specimens taken at the following localities have been identified by E. W. Nelson:

Georgia: Abbeville, 4; De Soto, 1; Americus, 1; Lumpkin, 2.

Alabama: Bon Secour, 1.

Lepus floridanus alacer Bangs.

BANGS COTTONTAIL.

This subspecies is found over the whole of Mississippi and the greater part of Alabama, and penetrates northwestern Georgia as far as the foot of the mountains. Whether or not it ranges on to the mountains was not determined. Specimens were taken at the following localities:

Georgia: Tate, 1.
Alabama: Huntsville, 3; Scottsboro, 1; Auburn, 1; Castleberry, 3.
Mississippi: Michigan City, 1; Holly Springs, 1; Fayette, 1.

Lepus floridanus mearnsi Allen.

MEARNS COTTONTAIL.

A specimen of this form was received from a collector at High Cliff, Campbell Co., Tenn. No specimens were secured at other points in East Tennessee, but this subspecies probably ranges over the Cumberland Plateau.

Lynx ruffus (Güldenstaedt).

EASTERN LYNX.

Lynxes are common on the upper slopes of Brasstown Bald, Georgia, where the dense rhododendron thickets and rocky cliffs afford a congenial habitat. A half-grown kitten was trapped close to our camp at 4,300 feet and a larger individual, caught near the summit, broke away with the trap and was lost. Lynxes occur throughout much of the wilder parts of the South, but no other specimens were secured.

Mephitis putida Boitard.

EASTERN SKUNK.

The large skunks are quite generally distributed in the Southern States, but on account of the lack of specimens the ranges of the two forms occurring there (*putida* and *elongata*) can not be defined. Specimens recently examined from western Alabama (Reform) are referable to *putida*, though the skulls show some approach to *elongata* in their characters. The latter form occurs in eastern Georgia and on the coast of Alabama and Mississippi.

Specimens have been examined as follows:

Tennessee: High Cliff, Campbell County, 1.
Alabama: Reform, 3.

Spilogale putorius (Linnaeus).

ALLEGHENIAN SPOTTED SKUNK.

These little skunks are much less common in the South than their larger relatives, and in many places are unknown to the residents. Records were secured of their occurrence at the following localities:

Georgia: Brasstown Bald, Towns County (common, 1 specimen, 4,000 feet alt.); Grassy Mountain, east of Jasper (reported common).
Tennessee: High Cliff, Campbell County (1 specimen); Briceville (reported scarce).
Alabama: Reform (reported); Castleberry (reported).

Putorius noveboracensis Emmons.

NEW YORK WEASEL.

This species is common in the mountains of North Carolina and there are numerous records from that State. Rhoads says it is reported to be common in West Tennessee,* but gives no definite records, nor are there any records of the species from farther south than North Carolina. A skin, without skull, taken at High Cliff, Campbell County, Tennessee, has been received by the Biological Survey.

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* Proc. Acad. Nat. Sci. Phila., 1896, p. 198.

Weasels were reported to me as occurring rarely at Reform and Castleberry, Alabama, but whether of this species or not is uncertain. Reports have been received also from W. J. Hoxie, of the capture of a weasel at Quitman, Georgia, and another near Savannah. These should doubtless be referred to *P. peninsulae.*

Sorex fumeus Miller.

SMOKY SHREW.

This species, known previously from as far south as Roan Mountain, North Carolina, was obtained on the summit of Brasstown Bald, Georgia (one specimen, ♂, July 16), and at High Cliff, Tennessee (one specimen, ♀, August 21). The specimen taken on Brasstown Bald was trapped in a dense growth of rhododendron, at the base of a cliff, at 4,700 feet altitude. The one from High Cliff was caught at 1,000 feet altitude, in a damp, heavily-timbered ravine, near the base of the north escarpment of Pine Mountain.

Sorex longirostris Bachman.

CAROLINA SHREW.

This diminutive species is very rare in collections, and has been recorded from only a few localities, in North and South Carolina. A specimen recently received from Young Harris, Georgia, is the first known from that State and extends the known range of the species into the Upper Austral Zone. The tail of this specimen measured (in the flesh) 32 mm., and the hind foot 10 mm. Another specimen in the Biological Survey, from Bicknell, Indiana, indicates that the species ranges into the Mississippi Valley.

Blarina brevicauda (Say).

LARGE BLARINA.

A single specimen of this shrew was taken, July 20, in a wet meadow at Young Harris (altitude 1,900 feet). It is intermediate between *brevicauda* and *carolinensis*, but seems nearer to the former. Its skull is about the size of skulls of *brevicauda* from the District of Columbia, but in external measurements it is somewhat smaller than those specimens.

Blarina brevicauda carolinensis (Bachman).

CAROLINA BLARINA.

Although recorded from both Mississippi* and Texas,† there appears to be no published record of this shrew from Louisiana. I took four specimens in the State in January, 1908—three at Natchitoches and one at Mansfield.

Blarina parva (Say).

SMALL BLARINA.

This species apparently ranges quite generally through the Southern

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* N. Amer. Fauna, No. 10, p. 14, 1895.

† N. Amer. Fauna, No. 25, p. 207, 1905.

States, but records of its occurrence are few and scattering.[*] A single specimen was taken at Belcher, Louisiana, February 6, 1908.

Scalopus aquaticus (Linnæus).

EASTERN MOLE.

Moles are quite generally distributed through the Southern States and are particularly numerous where the soil is light or sandy. On Brasstown Bald, Georgia, their runways were seen frequently all the way up the slope from the base to about 4,500 feet altitude.

Records are at hand of their occurrence at the following localities:

Kentucky: Barbourville (scarce; few runways seen).
Tennessee: Briceville (reported to occur); Walden Ridge, near Soddy (scarce).
Alabama: Huntsville (common; one specimen); Auburn (scarce); Castleberry (scarce); Bon Secour (scarce).
Georgia: Young Harris (common; five specimens); Crawfordville (one specimen); Americus (common).
Louisiana: Shreveport (common; three specimens); Clarks (one specimen); Natchitoches (one specimen).

Myotis grisescens Howell.[†]

GRAY BAT.

A large colony of these bats inhabit Nickajack Cave, near Shellmound, Tennessee, where I secured a series of 81 specimens on August 31. The species has been taken also at Marble Cave, Stone County, Missouri, and at Twin Cave, near Mitchell, Indiana. It will probably be found in most of the large caves in Tennessee, Kentucky, and other southern States. There is said to be a cave near Lim Rock, Alabama, inhabited by large numbers of bats—probably of this species.

Myotis subulatus (Say).

SAY'S BAT.

A single specimen of this bat, taken April 6, 1909, in a cave on Ivy Log Mountain, near Young Harris, Georgia, has been received by the Biological Survey. This is the first record of the species from the State.

Pipistrellus subflavus (F. Cuvier).

GEORGIAN BAT.

This is one of the most abundant and widely distributed bats in the South. Specimens were taken at the following localities:

Tennessee: Briceville (6, August 14, 17, 18); Soddy (2, August 25).
Georgia: Young Harris (1, July).
Alabama: Huntsville (1, September 8).

Eptesicus fuscus (Beauvois).

LARGE BROWN BAT.

Although of wide distribution in the United States, there are few records of its occurrence in the Southern States. Specimens were taken at the following localities:

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[*] See N. Amer. Fauna, No. 10, p. 18, 1895.

[†] For original description, see Proc. Biol. Soc. Wash., XXII, pp. 45–47, 1909.

Virginia: Tazewell (common; 1, August 4).
Tennessee: Soddy (1, August 25).
Georgia: Young Harris (2, July 10).

Lasiurus borealis (Müller).

RED BAT.

This bat ranges over most of the Southern States, and in many places is very common. Specimens were taken at the following localities:

Georgia: Young Harris (1, July 13).
Tennessee: Briceville (2, August 18); Coal Creek (1, August 19).

Nycticeius humeralis (Rafinesque).

RAFINESQUE BAT.

Specimens of this southern species are in the Biological Survey Collection from the following localities:

Alabama: Castleberry (1, October 12); Bon Secour (1, October 19); Greensboro (1, July 30, 1892); Point Clear, Mobile Bay (3, April 19, 20, 1892).

Corynorhinus macrotis (Le Conte).

BIG-EARED BAT.

Although this species apparently does not range north of the Lower Austral Zone on the Atlantic coast, it pushes up into the mountains to the upper edge of the Upper Austral. It has been recorded from Weaverville, North Carolina, and from the Pink Beds, Pisgah Forest, at 3,300 feet.*

I found the species in August at Burkes Garden, Virginia, at 3,200 feet altitude. An examination of four large caves and several small ones in this valley resulted in finding only ten or fifteen bats of this species in one of the larger caves. These caves are all in open pastures, the entrances being circular depressions in the surface of the field. The cave in which the bats were found was moist and cool, but contained no water. A single specimen of this bat was taken on Monte Sano, near Huntsville, Alabama, at an altitude of 1,600 feet. It was roosting in a small stone gate-house and was dislodged by a smudge built in the house, the smoke causing it to fall to the floor in a semi-conscious condition.

Specimens of this bat from the following localities have been examined:

Virginia: Burkes Garden (5, August 7).
Georgia: Young Harris (1, March 30, 1909).
Alabama: Monte Sano, near Huntsville (1, September 5).
Mississippi: Westville (1, head only, U. S. N. M. Coll).
Louisiana: Lobdell (1, March 4, 1903, U. S. N. M. Coll.); Tallulah (2, February 23, 1905).

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* H. C. Oberholser, Mamm. West. North Carolina, p. 9, 1905.

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PROCEEDINGS
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NEW GENERA, SPECIES AND SUBSPECIES OF FORMICARIIDÆ, FURNARIIDÆ, AND DENDROCOLAPTIDÆ.

BY ROBERT RIDGWAY.

[By permission of the Secretary of the Smithsonian Institution.]

Megastictus gen. nov. (*Formicariidæ.*)

Related to *Pygiptila* Sclater and *Thamnistes* Sclater and Salvin. Differing from the former in having the tail two-thirds as long as wing and much rounded or graduated (instead of much less than two-thirds as long and truncated); from the latter in relatively smaller bill (distance from nostril to tip of maxilla less than length of middle toe without claw) and very different coloration.

Type.—Myrmeciza margaritata Sclater.

(**Μέγας**, large; *στικτός*, marked, spotted.)

Myrmopagis gen. nov. (*Formicariidæ.*)

Related to *Myrmotherula* Sclater, but differing in relatively much longer tail (much more than half to more than two-thirds as long as wing), much stouter and relatively shorter and less depressed bill, the adult males neither streaked nor plain gray nor slaty.

Type.—Myrmothera axillaris Vieillot.

(**Μύρμηξ**, an ant; *παγίς*, a trap.)

Rhoporchilus gen. nov. (*Formicariidæ.*)

Related to *Drymophila* Such, but with nostril slit-like and very broadly operculate, rictal bristles obsolete, feathers of chin and forehead without trace of terminal setæ, tarsus nearly half as long as wing and with plantar scutella very distinct on both sides.

Type.—Formicivora speciosa Salvin.

(**Ῥώψ** (*ῥωπός*), bush, underwood, brushwood; *ὀρχίλος*, a wren.)

Myrmorchilus gen. nov. (*Formicariidæ.*)

Related to *Rhoporchilus* but rictal bristles obvious, feathers of chin and forehead with distinct terminal setæ, tarsus twice as long as middle toe without claw, and plantar scutella indistinct; differing from *Drymophila* in having nostrils slit-like and very broadly operculate, tarsus nearly half as long as wing, and other characters.

Type.—*Myiothera strigilata* Maximilian.

(Μύρμηξ, an ant; ὀρχίλος, a wren.)

Myrmoderus gen. nov. (*Formicariidæ.*)

Related to *Myrmeciza* Gray but tail much longer (more than five-sixths as long, sometimes longer than, wing, bill more slender, nostril larger and more longitudinal, and forehead more densely feathered, with feathers more compactly webbed, more decumbent; style of coloration very different.

Type.—*Myiothera loricata* Lichtenstein.

(Μύρμηξ, an ant; δέρω, I flay, cudgel.)

Contains also: *Myrmoderus cinnamomeus* (Gmelin), *Myrmoderus ruficaudus* (Maximilian), and *Myrmoderus atrothorax* (Boddaert). *Myrmeciza pelzelni* Sclater and *M. hemimelænus* Sclater, which I have not seen, may also belong here.

Phænostictus gen. nov. (*Formicariidæ.*)

Related to *Phlegopsis* Reichenbach but differing in relatively much longer tail (nearly as long as wing), scant loral and frontal feathering, rounded nostrils, partly nude malar region, more sharply ridged culmen, and other characters.

Type.—*Phlegopsis macleannani* Lawrence.

(Φαίνω, I display, exhibit; στικτός, marked, spotted.)

Hylophylax gen. nov. (*Formicariidæ.*)

Agreeing with *Pithys* Vieillot, *Anoplops* Cabanis, *Rhegmatorhina* Ridgway, *Phlegopsis* Reichenbach, etc. (and differing from *Hypocnemis* Cabanis), in having the second phalanx of middle toe partly united to outer toe and the acrotarsium fused (not scutellate) but differing from the first in absence of crests and very different character of nostrils, from the second in feathered orbital region and other characters; nearest *Sclateria*, but differing in relatively much shorter and broader bill and very different style of coloration.

Type.—*Conopophaga nævioides* Lafresnaye.

(Ὕλη, a wood, forest; φύλαξ, a watcher, guard, sentinel.)

Oropezus gen. nov. (*Formicariidæ.*)

Related to *Grallaria* Vieillot but tarsus half as long as wing (instead of less), more distinctly scutellate, the inner edge of planta distinctly convolute; bill more slender; upper parts not squamated.

Type.—*Grallaria rufula* Lafresnaye.

(Ὄρος, mountain; πεζός, walking.)

Hylopezus gen. nov. (*Formicariidæ.*)

Related to *Grallaria* Vieillot but nasal fossæ longer and narrower (distance from anterior end to base of exposed culmen equal to about two-thirds the distance from same point to tip of maxilla); nostrils more linear and separated from frontal feathering by naked integument; much weaker and more slender (nearly terete) bill, etc.

Type.—Grallaria perspicillata Lawrence.

(Ὕλη, a wood, forest; πεζός, walking.)

Premnornis gen. nov. (*Furnariidæ.*)

Related to *Margarornis* Reichenbach but tail excessively graduated (lateral rectrices less than half as long as middle pair), with tips of rectrices not distinctly acuminate, the minute points not distinctly protruded; wing less than four times as long as tarsus; inner webs of remiges with an extensive basal area (instead of sub-basal band) of ochraceous.

Type.—Margarornis guttata Lawrence.

(Πρέμνον, a stump, tree trunk; ὄρνις, bird.)

Drioctistes gen. nov. (*Furnariidæ.*)

Related to *Phacellodomus* Reichenbach and *Phaceloscenus* Ridgway but tarsus decidedly more than one-third as long as wing, the latter about two-thirds as long as tail; mesorhinium elevated and extremely compressed. Differing from *Thripophaga* Cabanis in much longer tarsus, greater anterior extension of latero-frontal feathering, unstreaked plumage, and other characters.

Type.—Thripophaga sclateri Berlepsch.

(Δρίος, a copse, thicket; κτίστης, a settler.)

Phaceloscenus gen. nov. (*Furnariidæ.*)

Related to *Phacellodomus* Reichenbach but wing relatively shorter (four-fifths as long as tail); tail graduated for nearly two-thirds (instead of only half) its length; tarsus not longer than middle toe with claw; bill relatively longer and narrower, and feathers of chest without thickened or widened shafts.

Type.—Anumbius striaticollis D'Orbigny and Lafresnaye.

(Φάκελος, a bundle; σκῆνος, a hut, tent.)

Schoeniophylax gen. nov. (*Furnariidæ.*)

Related to *Synallaxis* Vieillot but tail nearly twice as long as wing, and upper parts streaked.

Type.—Sylvia phryganophila Vieillot.

(Σχοινιά, a bunch of rushes; φύλαξ a watcher, guard, sentinel.)

Acrorchilus gen. nov. (*Furnariidæ.*)

Related to *Asthenes* Reichenbach but bill much stouter, with culmen much more strongly curved; tarsus much less than one-third as long as wing; and nostril and nasal operculum uncovered for much the greater part. Related also to *Synallaxis* Vieillot, but with 12, instead of 10, rectrices.

Type.—Synallaxis erythrops Sclater.

(ἄκρος, pointed; ὀρχίλος, a wren.)

Hyloctistes gen. nov. (*Furnariidæ.*)

Related to *Philydor* Spix but bill relatively much longer (exposed culmen longer than tarsus). Differing from *Automolus* in more extensive cohesion of anterior toes, the basal phalanx of middle toe wholly united to both lateral toes.

Type.—Philydor virgatus Lawrence.

(Ὕλη, a wood, forest; κτίστης, a settler.)

Rhopoctites gen. nov. (*Furnariidæ.*)

Related to *Automolus* Reichenbach but bill much stouter, less compressed (its width at latero-frontal antiæ nearly equal to its depth at same point), distinctly uncinate; shafts of rectrices more rigid at tip.

Type.—Philydor rufo-brunneus Lawrence.

(Ῥώψ (ῥωπός), bush, underwood, brushwood; κτίτης, a colonist, inhabitant.)

Automolus cervinigularis hypophæus subsp. nov.

Type from Guayabo, Costa Rica (Rio Reventazón). No. 209,532 U. S. Nat. Mus. March 19, 1908. Adult male. Museum-Zeledón Expedition, Francisco Basulto, collector.

Similar to *A. c. cervinigularis* but coloration decidedly darker, especially under parts of body (which are isabella color medially, darkening laterally into deep buffy olive and contrasting strongly and abruptly with the buff or ochraceous-buff of throat.

Acrorchilus erythrops griseigularis subsp. nov.

Type from San Antonio, Rio Cali, n. w. Colombia (altitude 5,800 ft.). No. 20,673, coll. E. A. and O. Bangs. Adult male. November 4, 1907. Mervyn G. Parker, collector.

Similar to *A. erythrops rufigenis* (Lawrence) of Costa Rica but rufous of head much more extensive, involving whole of occiput and nape, and color of under parts very different, the chest being mouse gray, passing through nearly ash gray on throat into grayish white on chin, only the flanks and under tail-coverts being light olive-brown or buffy olive (the general color of under parts in *A. e. erythrops* and *A. e. rufigenis*). Differs from *A. erythrops erythrops* in color of under parts and in different color (bright cinnamon-rufous instead of russet brown) of middle pair of rectrices.

Synallaxis albescens hypoleuca subsp. nov.

Type from Natá, Coclé, Panama. No. 150,814 U. S. Nat. Mus. March 31, 1889. Heyde and Lux.

Similar to *S. a. latitabunda* Bangs but under parts (including chest) nearly pure white (only the upper lateral portion of chest very faintly tinged with pale brownish gray), passing into pale buffy brown or light wood brown on under tail-coverts; general color of upper parts lighter and more buffy brown.

Dendrocolaptes validus costaricensis subsp. nov.

Type from Laguaria, Santa Maria de Dota, Costa Rica. No. 210,393 U. S. Nat. Mus. Adult male. June 4, 1908. Francisco Basulto.

Similar to *D. v. validus?* (from State of Santa Marta, Colombia)* but chest less distinctly streaked or with streaks less regular (broken along edges by black dots or bars) and under parts much more extensively barred.

Xiphorhynchus flavigaster yucatanensis subsp. nov.

Type from Temax, Yucatan. No. 106,292 U. S. Nat. Mus. Adult male. December, 1884. Geo. F. Gaumer.

Very similar in coloration to *X. f. mentalis*, of western Mexico, but throat always immaculate pale buff; much paler and grayer than *X. f. flavigaster*.

Xiphorhynchus punctigula insolitus subsp. nov.

Type from Cascajál, Coclé, Panama. No. 150,927 U. S. Nat. Mus. Adult female? February 13, 1889. Heyde and Lux.

Similar to *X. p. punctigula* but color of pileum and back much darker, the latter browner (nearly chestnut-brown), and general color of under parts much browner (brownish olive instead of greenish olive).

Xiphorhynchus lacrymosus rostratus subsp. nov.

Type from Rio Dagua, northwestern Colombia. No. 24,257 Field Museum of Natural History. Adult male.

Similar in coloration to *X. l. lachrymosus* but bill much stouter, relatively much deeper, with culmen strongly convex or arched, instead of straight for most of its length. Length (skin), 215 mm.; wing, 121; tail, 91; culmen, from base, 38; depth of bill at nostrils, about 10; tarsus, 24; middle toe, 20.

Picolaptes affinis neglectus subsp. nov.

Type from Coliblanco, Costa Rica. No. 199,582 U. S. Nat. Mus. Adult male. May 6, 1905. R. Ridgway.

Similar to *P. a. affinis* but stripes on under parts broader, more distinct on posterior portions; chin and throat more deeply buff, always more so than stripes on under parts of body.

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* The Santa Marta bird probably does not, however, represent true *D. validus*, the type locality of which is eastern Peru.

Campylorhamphus chapmani sp. nov.

Type from unknown locality in South America. No. 43,296 Am. Mus. Nat. Hist.

Somewhat like *C. pusillus* (Sclater) but streaks on under parts, as well as those on pileum and hindneck, broader; color of back lighter and more olivaceous; chestnut of wings and tail decidedly lighter, and bill smaller and more slender. Wing, 103 mm.; tail, 93; culmen (chord), 54; tarsus, 21; middle toe, 18.

Myrmeciza[*] **zeledoni** sp. nov.

Type from Guayabo, Costa Rica. No. 209,558 U. S. Nat. Mus. Adult male. March 7, 1908. Museum-Zeledón Expedition.

Similar to *M. immaculatus* (Lafresnaye), of central Colombia, but wing and tail much shorter, forehead much more scantily feathered, bill much larger, general color of adult male much deeper black, and white margin to wing much broader; adult female less rufescent above, tail more blackish, chin, malar, suborbital, and auricular regions blackish, and chest and foreneck brown instead of grayish. Adult male (type): Wing, 76 mm.; tail, 74; culmen, 24.5; tarsus, 34; middle toe, 23.[†]

Myrmeciza berlepschi sp. nov.

Type from Chimbo, western Ecuador. No. 97,774 U. S. Nat. Mus. Adult male. November, 1882. J. Siemiradzki.

Similar to *M. zeledoni*, from Costa Rica, but the adult male with much more white on anterior portion of wing, nearly the whole of the lesser covert area being white instead of the anterior margin only. Adult male (type): Wing, 83 mm.; tail, 76; culmen, 24; tarsus, 36.5; middle toe, 22.

This species apparently occurs also in Central Colombia, since Messrs. Von Berlepsch and Taczanowski compared specimens from Chimbo with others from Bogotá and pronounced them identical (Proc. Zool. Soc. Lond., 1883, p. 565). *Thamnophilus immaculatus* Lafresnaye, of which I have examined three adult males and one adult female from the Lafresnaye collection in the Boston Society of Natural History, is, however, a very different bird, and consequently authors have erred in identifying the species from western Ecuador and Costa Rica with *T. immaculatus.*

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[*] I am unable to find characters justifying the recognition of a genus *Myrmelastes*, as distinguished from *Myrmeciza*, and therefore place the present bird and its near allies, *M. berlepschi* and *M. immaculata* (Lafresnaye), in the latter. *Myrmelastes lawrencii* Salvin and Godman is the immature male (in second year?) of *Gymnocichla chiroleuca* and *M. corvinus* Lawrence (= *M. ceterus* Bangs) is the same of *G. nudiceps*.

[†] Measurements of the type of *M. immaculatus* are as follows: Wing, 82; tail, 84; culmen, 20; tarsus, 33; middle toe, 21.

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NEW RECENT CRINOIDS FROM THE INDIAN OCEAN.

BY AUSTIN HOBART CLARK.*

At the suggestion of Dr. F. A. Bather, the Indian Museum has entrusted to me for study the magnificent collection of recent crinoids brought together as a result of the operations of the Royal Indian Marine Surveying Steamer *Investigator*. Covering as it does the region from the Malay Peninsula to the Persian Gulf, the collection is one of extraordinary interest, for by its aid the westward extension of many East Indian genera can be accurately traced, and it is possible to form a very clear concept of the progressive diminution in intensity of the wonderfully rich East Indian fauna as one travels westward.

Most of the species in the collection are represented by large series, and there is an astonishingly complete representation of those very small forms so common in the East, which are frequently disposed of in published reports as "unidentifiable young," graphically bringing out the thoroughness with which the collectors of the *Investigator* performed their labors.

I wish to record my appreciation of the great kindness shown me by Dr. F. A. Bather and Dr. N. Annandale of the Indian Museum in entrusting to me a collection of such great interest and importance as is that of the *Investigator*.

The complete report upon this collection will be published by the Indian Museum in their series of monographs dealing with the Indian fauna.

FAMILY ZYGOMETRIDÆ.

GENUS EUDIOCRINUS P. H. Carpenter.

Eudiocrinus minor sp. nov.

Type.—Cat. No. 71B = [illegible] Indian Museum, from the Andaman Islands.

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* Published with the permission of the Superintendent of the Indian Museum, Calcutta.

Centro-dorsal a thin disk, the bare flat dorsal pole 1 mm. in diameter; cirrus sockets arranged in a single marginal row.

Cirri XII, 12, 5 mm. long; first two joints twice as broad as long, third half again as broad as long, fourth twice as long as broad; following joints very gradually decreasing in length, the antepenultimate being about one-third again as long as broad; third and fourth joints strongly "dice-box shaped," fifth and sixth slightly so, the following with practically straight edges; cirri proximally almost round in cross-section, after the fifth joint becoming laterally compressed, and therefore broader in lateral view; no dorsal spines or projections; opposing spine median, small, scarcely equaling one-fourth the diameter of the penultimate joint in height.

Arms and pinnules as in *Eudiocrinus ornatus*, the overlapping of the brachials and pinnulars being moderately marked; arms 15 mm. long.

Color (in spirits).—White.

FAMILY HIMEROMETRIDÆ.

GENUS DICHROMETRA A. H. Clark.

Dichrometra aranea sp. nov.

Type.—Cat. No. $\frac{5670}{7}$ Indian Museum, from 8° 51′ 30″ N. lat., 81° 11′ 52″ E. long.; 28 fathoms.

This new form is nearest to *D. finschii* from New Britain; it differs from that species in having somewhat fewer cirrus joints (53–66), and in having P_3 nearly or quite as long as P_2, while the joints in the distal portion of the proximal pinnules are much elongated, instead of subequal, slightly longer than broad as in *finschii*. The lower pinnules are comparatively slender, but slightly stiffened; P_2 is about as stout as P_1, and 2 mm. longer.

Color (in spirits).—Light brownish yellow.

GENUS CYLLOMETRA A. H. Clark.

Cyllometra mollis sp. nov.

Type.—Cat. No. 15F, Indian Museum, labeled, with a question mark, Kurrachi.

Centro-dorsal discoidal, thin, the polar area flat, 2 mm. in diameter; cirrus sockets arranged in one and a more or less partial second crowded row.

Cirri XX, 20–22, 10 mm. long; first joint short, second and third about twice as broad as long, the remainder very slightly broader than long becoming almost squarish on the terminal five or six; second and following joints with the distal dorsal edge produced and finely spinous, this projection progressively narrowing distally, at the same time very slowly moving to a more proximal position, after about the eighth becoming a pair of small subterminal tubercles, which on the last five to seven joints give place to small median tubercles; opposing spine much larger than the spines on the preceding joints, triangular, the apex terminal to nearly median, in height reaching to one-half or rather more of the diameter of the penultimate joint; terminal claw very slightly longer than the penultimate joint, moderately stout and moderately curved basally, becoming more slender and less curved distally.

Radials about even with the edge of the centro-dorsal; I Br_1 oblong, about three times as broad as long, not in contact basally; I Br_2 (axillary) pentagonal, about twice as broad as long, the lateral edges about half as long as those of the I Br_1, making with them a very obtuse angle; I Br series and lower brachials with a slightly indicated rounded median carination.

Arms 10, 65 mm. long, resembling those of *C. informis*, to which this species is most closely related.

P_a absent; P_1 small and weak, 4 mm. long with fourteen joints, the first short, the second squarish, the following gradually increasing in length, becoming twice as long as broad distally; joints in the distal third with the distal edges armed with fine spines; P_2 13 mm. long, stouter than P_1, though of the same proportions, with seventeen joints, which become squarish at the third and twice as long as broad terminally; second and following with a few spines on the distal edge; P_3 6 mm. long, basally as stout as P_2, but not tapering so rapidly, and therefore less delicate distally, with fifteen joints, the distal elongated; P_4 4 mm. long, not so delicate as P_1, with ten joints; P_6 3 mm. long, following pinnules increasing slowly in length, the distal pinnules being 7 mm. long, slender, with elongated joints.

Color (in spirits).—Brown, the perisome darker.

FAMILY TROPIOMETRIDÆ.

GENUS CALOMETRA A. H. Clark.

Calometra magnifica sp. nov.

Type.—Cat. No. 15A = $\frac{8417}{6}$ Indian Museum; Malay Archipelago, 160 fathoms.

Centro-dorsal hemispherical, the bare polar area convex, 2 mm. in diameter; cirrus sockets arranged in two or three closely crowded irregular marginal rows.

Cirri xx, 41–48, 40 mm. long; first cirrus joint short, the next two about twice as broad as long, the following gradually increasing in length to the fifth or seventh, which is about one-third broader than long; following joints similar to almost the middle of the cirrus, at which point they begin to decrease gradually in length, being twice as broad as long in the terminal portion; at about the eighth joint the median portion of the distal dorsal edge begins to project in a small Λ-shaped spine; this very slowly increases distally, the whole dorsal surface of the joint becoming rounded-carinate and rising somewhat at the same time, until in the terminal third the cirrus joints bear broad spatulate carinate processes, equal in height to about one-third their diameter; opposing spine triangular, similar in shape and size to the spine on the preceding joint, blunt, the apex terminal, arising from the distal two-thirds of the penultimate joint, about equal to half the diameter of the penultimate joint in height; terminal claw conical, equal in length to the penultimate joint, stout, slightly curved.

Disk completely covered with a pavement of rather small rounded plates, those in the angles of the calyx between the division series bearing conical processes in their centers; this calcareous covering is not closely united to the perisome beneath, except along the ambulacra, but draws away from it in drying; ambulacra with side and covering plates highly developed.

Ends of the basal rays visible as small, though prominent, tubercles in the angles of the calyx; radials even with the centro-dorsal, but over the ends of the basal rays extending upward in a narrow slightly wedge-shaped (base upward) process, which terminates distally in a spatulate process between the lateral edges of the I Br_2; I Br_1 short, slightly trapezoidal, not in contact basally, about four times as broad as long, rather strongly convex dorsally, with a rather prominent narrow rounded median ridge; I Br_2 (axillary) pentagonal, nearly or quite twice as broad as long, the lateral edges slightly shorter than those of the I Br_1, making with them an obtuse angle, with a narrow rounded median ridge similar to that on the I Br_1 in the proximal half; II Br 2, with the rounded median ridge much less prominent than on the I Br series.

Twenty arms about 120 mm. long; first brachial small, wedge-shaped, twice as broad as long exteriorly, almost entirely united interiorly; second brachial considerably larger, irregularly quadrate, both usually with a slight trace of a rounded median keel; third and fourth brachials (syzygial pair) oblong, half again as broad as long; next four brachials oblong, twice as broad as long, with a low tubercle in the proximal half of the median line; following two or three brachials wedge-shaped, the following triangular, about as long as broad; arm tips not preserved. On the lower part of the arm traces of tubercles are found on alternate sides of the median line; the proximal third of the arm is somewhat compressed laterally, and bears on either side a shallow lateral groove. The arms increase slowly in diameter up to about the twelfth brachial; from the fourth onward the brachials have moderately projecting finely spinous distal edges. Syzygies occur between the third and fourth brachials, again between the eighteenth and nineteenth (rarely the seventeenth and eighteenth or twentieth and twenty-first), and distally at intervals of four to nine (usually six to eight) oblique muscular articulations.

P_1 8 mm. long, slender and weak, with twenty joints, the first broad, slightly wedge-shaped, about twice as broad as the length of its proximal edge, produced distally into a high rounded carinate process; second joint longer, half again as broad as long, bearing a large fan-shaped carinate process with a scalloped or dentate distal edge; third and fourth considerably less in diameter than the second, slightly longer than broad, with strong oblong carinate processes; following joints non-carinate, slowly increasing in length, becoming twice as long as broad in the terminal portion; after the second joint the pinnule is rather sharply triangular; in the distal half the joints project somewhat over the bases of the succeeding joints at the angles of the prism, this increasing toward the tip where the ends of the joints overlap all around and are more or less spinous; P_2 14 mm. long, slender, but stiff, with twenty-one joints;

first joint broad, about twice as wide as its proximal diameter, roundedly carinate distally; second joint wedge-shaped, about as broad as long proximally, with a thin carinate process about twice as broad as high distally; third one-third longer than broad, strongly carinate distally, but the carination not quite so high as that on the preceding joint; fourth twice as long as broad, carinate distally like the third; following joints about two and one-half times as long as broad, slightly longer in the terminal part; the pinnule is strongly styliform, the joints being more or less produced anteriorly at the angles of the prism in the shape of a spine overlapping the bases of the succeeding joints; the distal ends of the joints are somewhat prominent and finely spinous, this becoming more pronounced distally; P_3 15 mm. long, similar to P_2, though very slightly stouter; P_4 14 mm. long; P_5 12 mm. long; P_6 10 mm. long, similar to P_5, but with proportionately somewhat longer joints, which in the distal portion have more expanded ends; P_6 has fifteen joints; P_7 10 mm. long, slightly stouter than P_6, with about the same number of joints, which are proportionately rather shorter; P_8 9 mm. long, stouter than P_7, especially on the third, fourth and fifth joints, none of which are more than twice as long as broad; following pinnules of the same length and in general similar; the third—seventh joints are somewhat broadened, the pinnule tapering evenly from a maximum width on the fourth to a slender tip, with much elongate joints which have expanded and spinous distal ends; distal pinnules slender, 10 mm. long.

Color (in spirits).—White.

Calometra spinosissima sp. nov.

Type.—Cat. No. 13B = [illegible] Indian Museum; from the Andaman Islands.

Centro-dorsal discoidal, moderately thick, the bare polar area flat, 3 mm. in diameter; cirrus sockets arranged in a single crowded marginal row.

Cirri moderately slender, xl, 42-55, 25 mm. long; first joint about three times as broad as long, the following slowly increasing in length to the sixth or seventh, which is nearly as long as broad, then remaining similar to the twelfth or fifteenth, then very gradually decreasing so that the joints in the terminal portion are twice as broad as long; at about the fifteenth joint a low sharp dorsal keel makes its appearance, at first in the distal portion only, but soon along the entire dorsal surface, which very slowly increases in height, becoming very prominent on the short terminal joints, though never exceeding more than one-fourth their diameter in height; opposing spine and terminal claw as in *C. multicolor*, to which form this species is most closely related.

Disk lacking; side and covering plates very highly developed along the brachial and pinnule ambulacra.

Ends of the basal rays visible as small rhombic areas in the angles of the calyx, but not raised above the general surface of the radials, and therefore not especially obvious; radials short in the median line, but extending up into the angles of the calyx in the form of an equilateral triangle, the rounded apex of which entirely separates the bases of the I Br$_1$; I Br$_1$ slightly trapezoidal, about twice and one-half as broad as long, the ventrolateral margins very thin; I Br$_2$ (axillary) pentagonal, as long as, or only slightly shorter than, broad, the lateral edges nearly or quite as long as those of the I Br$_1$, slightly constricted just below the lateral angles; II Br 2, the first united in the proximal two-thirds, diverging at approximately a right angle distally.

Nineteen arms (in the type) 130 mm. long, resembling in the main those of *C. multicolor.*

P_1 10 mm. long, very slender and weak, with thirty-five joints, the first proportionately very much enlarged, twice as broad as long, with a strong carinate process, the second much shorter, strongly trapezoidal, the remainder very small and squarish; P_2 somewhat longer, but stiff and spine-like, with elongated joints like P_3; P_3 20 mm. long, not especially stout but very stiff, with about twenty joints, the first about twice as broad as long, slightly carinate, the second trapezoidal, about as broad distally as the proximal length, the third half again as long as broad, the fourth over twice as long as broad, the remainder two and one-half to three times as long as broad and even longer distally; the joints have slightly projecting and spinous distal ends, this character increasing in intensity distally; P_4 similar to P_3 and of the same length; the following pinnules decrease to 12 mm. on P_6, then become somewhat stouter, and more slender again distally, though remaining of the same length; the joints in the distal portion of all the pinnules have prominent, somewhat expanded, spinous distal ends. The pinnules on the outer arms of each ray appear to be considerably longer than those on the inner.

Color (in spirits.)—White, thickly blotched on the rays, arms, and pinnules with purple, which color also forms on the rays and division series a more or less defined dorso-lateral line.

FAMILY THALASSOMETRIDÆ.

SUBFAMILY THALASSOMETRINÆ.

GENUS CROTALOMETRA A. H. Clark.

Crotalometra rustica sp. nov.

Type.—Cat. No. 19A = $\frac{8409}{6}$ Indian Museum; Malay Archipelago, 30 fathoms.

Centro-dorsal apparently as in *C. magnicirra*, with the cirrus sockets arranged in ten columns, two in each radial area.

Cirri XX, about 70 (69 to broken tip), 85 mm. long, large and stout; first three joints subequal, about three times as broad as long, fourth slightly longer, fifth squarish or slightly longer than broad, following joints about one-third longer than broad, after the eighteenth becoming squarish, and after four or five more about twice as broad as long; eighteenth a transition joint; after the transition joint the dorsal surface of each joint gradually rises to a subterminal dorsal tubercle, which, however, never projects in the form of a spine; the tubercle is at first rather broad transversely and rounded dorsally, but distally it becomes narrower, so that the dorsal surface of the joints becomes bluntly carinate. The dorsal edge of the cirri presents a slightly serrate appearance.

Ends of the basal rays visible as prominent dorso-ventrally elongate tubercles in the angles of the calyx; radials projecting very slightly beyond the edges of the centro-dorsal; I Br$_1$ very short, band-like, above five times as broad as long, convex proximally, concave distally, in close lateral apposition; I Br$_2$ (axillary) broadly pentagonal, half again as broad as long, all the sides strongly concave; the lateral edges of the two components of the I Br series taken together are evenly and strongly concave, the proximal width of the I Br$_1$ and the distal width of the I Br$_2$ being about the same; both these joints are sharply flattened laterally, with the apposed edges somewhat everted. II Br 4 (3 + 4), very strongly rounded dorsally like the I Br, in close lateral apposition and sharply flattened, the lateral edges somewhat produced; the joints of this division series are proportionally rather long.

Twenty arms about 150 mm. long, deep and compressed, strongly rounded dorsally; first brachial very short, strongly concave anteriorly; second brachial much larger with a posterior rounded process incising the first; third and fourth brachials (syzygial pair) about as long as broad, concave dorsally and laterally like the II Br$_{3+4}$; following brachials to the ninth wedge-shaped, half again as broad as long; following brachials triangular, about as long as broad, in the terminal portion of the arm becoming wedge-shaped and slightly longer. After the proximal third of the arm the brachials develop prominent and spinous distal ends and a striated dorsal surface. Syzygies occur between the third and fourth brachials, again between the fifteenth and sixteenth to nineteenth and twentieth, and distally at intervals of four to nine oblique muscular articulations.

P_D 15 mm. long, large and stout in the basal half, then tapering to a slender tip, with about twenty-five joints, the second—seventh broader than long, the remainder about as long as broad; P_1 12 mm. long, with twenty-three joints, much less stout than P_D, the outer joints somewhat spinous along their dorsal ridge; P_2 7 mm. long, considerably more slender than P_1, tapering evenly from the base to the end of the proximal half, slender from there onward, with sixteen joints, all but the first two approximately squarish; following pinnules about the same length, but scarcely tapering at all until near the tip, hence appearing somewhat stouter; they are composed of about fourteen joints; distal pinnules moderately slender, 12 mm. long with twenty joints, the first trapezoidal, about twice as broad distally as its median length, the second trapezoidal, somewhat broader distally than the median length, the remainder slightly longer than broad; the dorsal ridge is very sharp and more or less spinous.

Color (in spirits).—White.

SUBFAMILY CHARITOMETRINÆ.

GENUS PACHYLOMETRA A. H. Clark.

Pachylometra macilenta sp. nov.

Type.—Cat. No. 1G Indian Museum; 10° 47′ 45″ N. lat., 72° 40′ 20″ E. long.; 705 fathoms.

Centro-dorsal a short truncated cone, moderately large, the bare polar area flat, 2.5 mm. in diameter; cirrus sockets arranged in ten columns of usually two each, the columns of adjacent radial areas closely crowded and more or less alternating, those within the same radial area usually slightly separated anteriorly.

Cirri xx, 21–22, 25 mm. to 36 mm. long, comparatively long and slender; first joint very short, second twice as broad as long, third about as long as broad, following gradually increasing to the sixth, which is about half again as long as broad; next two or three joints similar, the following very gradually decreasing in length, those in the terminal third of the cirrus being about as long as broad; antepenultimate joint about one-third longer than broad; penultimate joint half again as long as broad, slightly less in diameter than the preceding; opposing spine very small, though prominent, terminally situated, directed obliquely forward; terminal claw about as long as the penultimate joint, stout basally, becoming slender in the distal half, moderately curved. The cirri are moderately compressed in the distal two-thirds; the two or three joints before the penultimate have slight traces of terminal dorsal tubercles.

Disk covered with a pavement of very small plates; side and covering plates well developed along the ambulacra.

Ends of the basal rays visible as large rhombic tubercles in the angles of the calyx; radials only visible as a large transversely oblong tubercle between the centro-dorsal and the I Br$_1$; I Br$_1$ very short, arcuate, in close lateral apposition, the proximal edge more or less crenulate, and bearing a large and rather high transversely oval median tubercle; I Br$_2$ (axillary) rhombic, very short, somewhat over twice as broad as long, the edges somewhat crenulate and somewhat produced, the proximal imbricating more or less over the anterior border of the I Br$_1$; the lateral edges are very short, in close apposition; it bears a rather large and high rounded median tubercle; II Br 4 (3 + 4) in close lateral apposition and sharply flattened, with the lateral edges slightly everted; the distal edge of II Br$_1$ is somewhat everted, and the proximal edge of II Br$_2$ more strongly everted, the latter imbricating slightly over the former except in the median line; II Br$_1$ usually bears a strong rounded median tubercle like that on the two components of the I Br series.

Thirteen arms (in the type) 170 mm. long, elongated and comparatively slender, resembling those of *P. robusta*.

The pinnules in general resemble those of *P. robusta*, but the pinnules in the proximal part of the arm are strongly carinate.

Pachylometra investigatoris sp. nov.

Type.—Cat. No. 13A = $\frac{8407}{6}$ Indian Museum; Malay Archipelago, 30 fathoms.

Centro-dorsal a truncated cone, 7 mm. broad at the base and 5 mm. high, the cirrus sockets arranged in two columns of three to five each in each radial area, the two columns of each area separated by a narrow median line not quite so broad basally as the cirrus sockets, distally narrowing and ending in a point at about the level of the third or fourth cirrus socket; the columns of each area are closely crowded against, and tend to alternate with, the columns in adjacent areas.

Cirri XL, 25–28, about 40 mm. long; first joint very short, second and third equal in size, about twice as broad as long, fourth slightly longer, fifth as long as broad; sixth, seventh and eighth joints the longest, slightly longer than broad to about one-third again as long as broad, the following very gradually decreasing in length so that those in the distal half are about as long as broad, or, in some cases, slightly broader than long; third joint from the end slightly longer than broad; antepenultimate about one-third longer than broad; penultimate, which is somewhat less in diameter than the preceding, half again as long as broad; distal dorsal edge of the distal joints showing an inclination to develop low blunt tubercles; opposing spine represented by a small blunt tubercle, terminally situated; terminal claw long, about as long as the penultimate joint, moderately slender, and moderately curved. The cirri are rounded basally, but moderately compressed in the distal two-thirds; there is no trace of carination.

Disk completely covered by a pavement of small plates; side and covering plates strongly developed on the pinnule ambulacra.

Ends of the basal rays visible as large rhombic tubercles in the angles of the calyx; radials concealed; I Br$_1$ short, four or five times as broad as long, chevron-shaped, with a more or less wavy proximal and distal border, in close lateral apposition; the apposed edges are somewhat thickened and produced and there are a few low broad tubercles on the distal border; I Br$_2$ (axillary) rhombic, twice as broad as long, rising to a rather sharp dorso-ventrally elongate tubercle with the I Br$_1$; II Br 4 (3 + 4); on three of the II Br series the syzygy is replaced by a synarthry; III Br 2 (1 + 2), developed interiorly. The division series are very strongly rounded dorsally and have a slightly indicated median carination; they are in very close lateral apposition and the lateral edges are slightly produced and everted as in *Glyptometra*.

Thirty-two arms (in the type) 150 mm. long; first two or four brachials oblong, short, united in syzygial pairs which are not quite so long as broad; following two or three brachials oblong, somewhat over twice as broad as long, then becoming wedge-shaped, twice as broad as long, and slightly longer and more oblique after the proximal third of the arm, where the brachials have slightly prominent distal ends.

P_D 17 mm. to 20 mm. long, very slender and flagellate distally, with from fifty to fifty-three joints: first two joints disproportionately large, twice as broad as long, strongly flattened exteriorly; third joint about half as broad as the first and half as long as the second, twice as broad as long; following joints to the fifteenth decreasing in diameter and increasing in length, at first twice as broad as long, becoming after the fifteenth uniformly small and about as long as broad; P_1 about the same length with forty-five joints, similar, but much less stout basally and not tapering so rapidly; P_2 13 mm. long with about thirty joints about as stout basally as the preceding pinnules, but tapering much more gradually, the first eight joints about three times as broad as long, then gradually becoming longer and squarish about the eighteenth and in the terminal part longer than broad; P_3 about 15 mm. long, and P_4 16 mm. or 17 mm. long, resembling P_2; P_5 similar, 13 mm. long; P_6 similar and of the same length; P_7 and the following pinnules 12 mm. long with the joints in the proximal two-thirds slightly expanded laterally; in the next four or five the pinnules decrease in length to 8 mm., while the expansion of the joints becomes more pronounced, beginning on the second, reaching a maximum on the fourth or fifth, then gradually dying away distally; distal pinnules stout as in the other species of the genus, 10 mm. long.

Color (in spirits).—Yellowish brown.

FAMILY ANTEDONIDÆ.

GENUS EUMETRA A. H. Clark.

Eumetra indica sp. nov.

Type.—Cat. No. 4G, Indian Museum; Port Blair, Andaman Islands.

Centro-dorsal conical, 3 mm. broad at the base and 3 mm. high, the cirrus sockets arranged in six closely crowded alternating rows. The centro-dorsal as a whole resembles closely that of *Hathrometra*.

Cirri about LXX, all lacking.

Radials extending slightly beyond the edge of the centro-dorsal, diverging at an acute angle in the angles of the calyx; I Br_1 somewhat trapezoidal, about three times as broad as long, not in contact basally; I Br_2 (axillary) rhombic, the free lateral edges rather longer than those of the I Br_1, forming with them somewhat more than a right angle; synarthrial tubercles moderately developed.

Ten arms, about 60 mm. long; first brachial longer outwardly than inwardly, slightly incised by the second, not united interiorly, but the inner edges diverging at approximately a right angle; second brachial nearly twice as large, irregularly quadrate, with a rounded posterior projection incising the first; third and fourth brachials (syzygial pair) about as long as broad; next eight or nine brachials slightly wedge-shaped, half again as broad as long, then becoming almost or quite triangular, about as long as broad, and further out on the arm wedge-shaped again and longer than broad. Syzygies occur between the third and fourth, ninth and tenth, and fourteenth and fifteenth brachials, and distally at intervals of three oblique muscular articulations.

P_1 about 6 mm. long, very slender and delicate, somewhat stiffened, with about nine joints, the first about as long as, or slightly longer than, broad, the second and third twice as long as broad, the following gradually increasing in length and becoming exceedingly elongated distally; P_2 about 10 mm. long, proportionately stouter than P_1 and stiffer, with fifteen joints, the first squarish, the second slightly longer than broad, the third twice as long as broad, the remainder three to four times as long as broad; P_3 8 mm. long with fifteen joints, similar to P_2 but slightly less stout; P_4 like P_3; P_5 5 mm. long, slightly more slender than P_4, with ten joints, which have slightly everted spinous distal ends; following pinnules similar; the distal pinnules are lacking.

Color (in spirits).—Light brownish yellow with traces of a broad median dorsal line of purple.

FAMILY PENTACRINITIDÆ.

GENUS METACRINUS P. H. Carpenter.

Metacrinus batheri sp. nov.

Type.—Cat. No. $\frac{4410}{6}$, Indian Museum; Malay Archipelago; 160 fathoms.

Stem stout, 7 mm. in diameter, strongly stellate in cross section, with the produced interradial angles broadly rounded instead of sharp; cirrus sockets confined to the nodals, transversely oblong, the shorter diameter equal to the height of the nodals; nodals produced at the interradial angles into high dorso-ventrally elongate tubercles, occupying their entire lateral edges; internodals six or seven, alternating in size, the longer with the angles produced into dorso-ventrally elongate tubercles resembling those on the nodals, but somewhat smaller; radial faces of internodals with low broad rounded ridges, showing a tendency to break up into tubercles, between the produced interradial angles.

Cirri 45 mm. to 50 mm. long (about seven times the diameter of the stem) with forty-eight to fifty joints, the first four very short, subequal, the following increasing to the ninth which is nearly, or quite, as long as broad, then remaining similar for five or six joints and very gradually decreasing in length distally, so that the later joints are about twice as broad as long; cirri at first transversely oval in cross section, gradually becoming round and after the first six or seven joints laterally compressed; on the terminal six or seven joints there are indications of a median tubercle; terminal claw as long as the two preceding joints, conical, only slightly curved.

Basals very prominent, shield shaped, in lateral apposition all around the calyx, strongly produced downward over the angles of the stem; radials narrow and band-like, of equal height all around the calyx, four or five times as broad as long in the median line; I Br 4 (1 + 2); II Br five to eleven (usually about seven); arms dividing four or five times, with usually one more axillary exteriorly than interiorly in reference to the II Br series; arms as far as the III Br axillary robust, the articular tubercles rather strongly indicated, the dorsal surface perfectly smooth; beyond the III Br axillary the brachials have prominent finely spinous distal ends, and are rough to the touch.

The pinnules are essentially like those of *M. acutus*.

Color (in spirits).—White.

VOL. XXII, PP. 87-90 APRIL 17, 1909

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

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GENERAL NOTES.

THE TYPE OF THE GENUS *COMASTER*.

The genus *Comaster* was established by Professor Agassiz in 1836 to contain the comatulids in which the rays divide more than once. He cites as the type *Comatula multiradiata* Lamarck. The specific name *multiradiata* was first used by Linnæus in 1758, the type specimen being still extant at Lund. Lamarck includes under his *Comatula multiradiata* as a questionable synonym the *Asterias multiradiata* of Linnæus. I have previously considered the *multiradiata* of Lamarck to be a synonym of the *multiradiata* of Linnæus because of this, and because one of Lamarck's specimens is identical with the Linnæan type. But the case can not be disposed of so easily. In 1832 Goldfuss described and figured another *multiradiata* based upon a specimen at Bonn. Müller, in revising the group, decided that the name *multiradiata* must hold for the species which had been adequately described—that of Goldfuss—and he redescribed the Lamarckian *Comatula multiradiata* under the name *Alecto multifida* from observations made by Troschel on Lamarck's specimens. This action fixes the identity of the *Comatula multiradiata* of Lamarck, and, therefore, of the type of *Comaster*. *Alecto multifida* is a somewhat anomalous species, congeneric with, though not closely related to, *Phanogenia typica* of Lovén. *Comaster* must, therefore, supplant *Phanogenia*. This leaves the genus which I have previously called *Comaster* without a name. It may be called **Capillaster**, the type to be *Actinometra sentosa* P. H. Carpenter, 1888.

The type of *Comaster* is *Comatula multiradiata* Lamarck (not *Asterias multiradiata* Linnæus) = *Alecto multifida* J. Müller.

—*Austin H. Clark.*

PHOTOTAXIS AMONG CRINOIDS.

While on board the *Albatross* among the Philippine Islands, Dr. Paul Bartsch captured a small specimen of *Iridometra nana* which had been attracted to, and was swimming about, a submerged electric light. So far as I know this is the first record of positive phototaxis among the crinoids. It should be remembered that the specimen is only about half the adult size, as it is possible, and even probable, that the reactions of the adult of this species are quite different.

—*Austin H. Clark.*

SYSTEMATIC POSITION OF *OLIGOMETRA STUDERI.*

By an unfortunate slip I described a new comatulid from Dirk Hartog Island, West Australia, under the name of *Oligometra studeri*, whereas it belongs in reality to the genus *Cyllometra*, and should have been called *Cyllometra studeri*. *Cyllometra studeri* is related to *C. informis* which was taken by the *Challenger* among the Philippine Islands in 18 fathoms. Another specimen in the U. S. National Museum from off the northern end of Samal Island, 23 fathoms, appears to be typical, agreeing perfectly with Carpenter's figure.

Cyllometra studeri differs from *C. informis* most obviously in its smooth pinnules, the lower and middle pinnules in the latter having slightly overlapping and spinous ends to the joints, and in the much greater length and greater slenderness of P_2, which is twice as long as P_3 with eighteen joints most of which are elongated, instead only slightly when at all longer than P_3 with twelve joints, most of which are squarish. Both species are readily distinguished from the others of the genus by the small number of cirrus joints. —*Austin H. Clark.*

THE ALLEGHENY CAVE RAT AT NEWFOUNDLAND, N. J.

The only positive record of the occurrence of *Neotoma pennsylvanica* in New Jersey is that of the capture of three individuals by Mr. Samuel N. Rhoads at Bearfort Mountain, Passaic County, N. J. During a three days' visit to the same county in July, 1908, four specimens were caught by the writers on the eastern side of Mount Jefferson, near the village of Newfoundland. This part of the mountain consists mainly of a high cliff, with piles of large boulders at the bottom; and it is among these rocks that the rats live.

During the night of July 3d an adult male and an adult female were trapped at the northern end of this cliff; and two nights later another adult male and a young female were captured in the same manner about one-half mile to the south. Gnawed acorns and other signs of the presence of "mountain rats" were to be seen in several additional places along the cliff, while Mr. Daniel Bigelow, of Newfoundland, told us they were also to be found on the mountain near Green Pond, about four miles to the southwest. —*W. DeW. Miller* and *James Chapin.*

ON THE NAME OF THE ANTILLEAN KILLDEER.

The small resident West Indian Killdeer named *Charadrius torquatus* Linnæus (Sys. Nat. ed. 12, I, p. 255, 1766), has this name unfortunately preoccupied by *Charadrius torqvatus* Pontoppidan (Danske Atlas, I, 1763, 625; based on Brisson, Orn. Gen. 69, sp. 7 = *Charadrius hiaticula* Linn.). As *Charadrius Jamaicensis* Müller (Linne's Natursys. Suppl., p. 117, 1776; founded on Brown, Jamaica, p. 477) can not be identified with any degree of certainty, the Linnæan species may be called **Oxyechus vociferus rubidus.** —*J. H. Riley.*

CORRECTIONS REGARDING THE NAMES OF TWO RECENTLY DESCRIBED AMPHIBIA SALIENTIA.

In a paper on the Reptilia and Amphibia of Gorgona Island, Colombia (Bull. Mus. Comp. Zool., vol. 46, no. 5, p. 101, June, 1905), the writer described a new frog, to which by a curious inadvertence the name *Prostheraspis* (sic) *femoralis* was given. This name is preoccupied by *Prostherapis femoralis* Boulenger, described from the Huallaga River, northern Peru (Boulenger, Proc. Zool. Soc., London, 1883, p. 635, pl. 57, fig. 1). Since the Gorgona Island species is quite distinct, it must therefore be re-named, and may stand as **Prostherapis boulengeri** Barbour.

A correction is also to be made in the case of *Cacopoides borealis* Barbour, described as the type of a new genus and species in a paper on "Some New Reptiles and Amphibians" (Bull. Mus. Comp. Zool., vol. 50, no. 12, p. 321, April, 1908). It appears that this must now be considered identical with *Callula verrucosa* Boulenger, though considerably variant from the type of that species and vastly removed from it in range. Boulenger's specimen came from Yunnan, while that on which the supposed new species was based, was collected at Antung, Manchuria.

—*Thomas Barbour.*

THE AUTHORITY FOR THE NAME *NYCTICEBUS MENAGENSIS*.

The Philippine Slow Lemur was originally called *menagensis* without assignment to any genus in an article in the Zoologischer Anzeiger for 1892, volume XV, page 147. Prof. H. F. Nachtrieb was apparently the author of the article, but in a letter to me dated June 7, 1906, he attributed the account as printed to Prof. Dean C. Worcester. (See Lyon, Proc. U. S. Nat. Mus., XXXI, p. 531, footnote, November 9, 1906.) As a specific name published without inclusion, even questionably, in any genus has no valid standing, *Nycticebus menagensis* can not date from 1892 and can not be attributed to either Nachtrieb or Worcester. Mr. Oldfield Thomas has recently attempted to show (Ann. Mag. Nat. Hist., 8th ser., I, p. 469, June, 1908) that the name should date from Trouessart's Catalogus Mammalium, 1897, and that Trouessart should be credited with the authorship of the name as being the first to use *menagensis* in combination with a genus of lemurs. An earlier use of the name in a binomial sense, however, was made by Lydekker in the Zoological Record for 1892, volume XXIX, published in 1893, on page 25, under Mammalia, where the combination *Lemur menagensis* occurs as well as a reference to the original account of the species by Nachtrieb and Worcester. It would seem, therefore, that the scientific name of the Philippine Slow Lemur should stand as *Nycticebus menagensis* (Lydekker) and date from 1893.

-- *Marcus Ward Lyon, Jr.*

THE GENERIC NAME *NYCTERIS*.

The generic name *Nycteris* as used for a group of Old World bats is currently assumed to date from Geoffroy and Cuvier, 1795.[*] In reality it was not published in this sense until 1803,[†] the name as it occurs in the earlier work being strictly a *nomen nudum*.[‡] But during this interval of eight years *Nycteris* had been applied by Borkhausen[§] and Bechstein[‖] to a very different animal, the New York Bat of Pennant, now currently known as *Lasiurus borealis*. It is therefore necessary to substitute *Nycteris* Borkhausen 1797 for *Lasiurus* Gray 1831,[¶] *Petalia* Gray 1838[**] for *Nycteris* Geoffroy 1803,[††] and the new family name *Petaliidæ* for *Nycteridæ* Dobson 1875.[§§]

—*Gerrit S. Miller, Jr.*

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[*] Geoffroy and Cuvier, Magasin Encyclopédique, 1e année, II, p. 186.

[†] Geoffroy, Catal. Mamm. Mus. Nat. d'Hist. Nat., Paris, p. 64.

[‡] "Nyctère (*Nycteris*)."

[§] Der Zoologe (Compendiose Bibliothek gemeinnützigsten Kenntnisse für alle Stände, pt. XXI) Heft IV–VII, p. 66, 1797, type *Vespertilio novcboracensis* Erxleben. Deutsche Fauna, I, p. 86, 1797 (no type mentioned).

[‖] Bechstein used the same name in his translation of Pennant's Synopsis of Quadrupeds, 1800, and in his Gemeinnützige Naturgeschichte Deutschlands, 1801, though in the latter no species is mentioned.

[¶] Zoological Miscellany, No. 1, p. 38.

[**] Mag. Zool. and Bot., II, p. 494. Type *Nycteris javanicus* Geoffroy.

[††] Unless one of the orthographic variants, *Nicteris* Desmarest 1803 (Nouv. Dict. d'Hist. Nat., XV, p. 501) or *Nycterus* Fischer 1813 (Zoognosia, I, p. 18) be regarded as a distinct name.

[§§] Ann. and Mag. Nat. Hist., 4th ser., XVI, p. 348 (part). Miller, Families and Genera of Bats, p. 99, 1907.

VOL. XXII, PP. 91-94 JUNE 25, 1909

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON THE FISHES OF CRAB CREEK, WASHINGTON, WITH DESCRIPTION OF A NEW SPECIES OF TROUT.*

BY BARTON WARREN EVERMANN AND
JOHN TREADWELL NICHOLS.

Reports having come to the Bureau of Fisheries from time to time of the presence of a peculiar and interesting trout in Crab Creek, Washington, it was decided to secure specimens of it whenever a suitable opportunity presented itself.

In the summer of 1908, while Mr. Nichols was engaged in studying the operation of the salmon wheels on the Columbia River, advantage was taken of his presence in that part of the country to visit Crab Creek, make a study of the local conditions and collect specimens of the trout and other fishes inhabiting that stream. Accordingly on July 29 Mr. Nichols, accompanied by Mr. Ruskin Lhamon as temporary assistant, drove from Ritzville northward about 12 miles to Rocky Ford where Crab Creek was examined and collections made. The road from Ritzville is through a very dusty rolling grain country. At the point visited Crab Creek runs in the bottom of a coulée apparently cut by a much larger stream. Along its immediate banks is a green strip of small trees and shrubs, willows, poplars and alders, but the rocky slopes and ledges of the coulée rise toward the upland, uncultivated and scantily clothed with grey-green, rank-smelling sage brush, dazzling to the eye under the desert sun. The water of the stream was clear and cold, about 53° Fahrenheit. Its shallows were overgrown with water crowfoot in flower.

Several species of wading birds were observed, such as kildeers which were especially common and noisy, and kingfishers which were much in evidence.

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* Published by permission of the Commissioner of Fish and Fisheries.

Crab Creek has its rise near the western line of Spokane County, Washington. Its general course is westerly until it reaches the vicinity of the lower end of the Grand Coulée. It then turns southward toward Moses Lake. At the little town of Odessa, again just below the mouth of Wilson Creek (its principal northern tributary), and probably at other places, the creek sinks, usually to reappear further down. During high water it sometimes reaches Moses Lake, though it is said usually not to do so. At the lower end of Moses Lake are great sand dunes and sandy wastes placed across the old drainage channel of the creek. Through these the water seeps to reappear on the surface at intervals between the dunes and the Columbia which the waters finally reach. Although it is quite certain that at one time previous to the late pleistocene, Crab Creek flowed into the Columbia, it evidently has not done so for many years.

In its upper reaches the water is pure and sweet, but just above Moses Lake, according to Lieut. Symons,* it becomes somewhat alkaline. That of Moses Lake is stagnant alkaline, and unfit for drinking. Below the lake the water is alkaline, filled with organic matter, and unpalatable.

The water of the creek stood in deep, still pools the largest of which was thirty feet or more across and ten feet or so in depth. Between the pools were shallows where the current was not very strong, and only a few miles up stream from the largest pool, the creek became a mere rill which one could almost step across. Persons living in the neighborhood said that varying volume from point to point along its course was characteristic of Crab Creek.

Trout were found in considerable abundance but, probably owing to an abundant food supply, they did not take the fly or baited hook with any avidity. Young trout two to three inches long were abundant in the creek and some were found in an irrigating ditch which received its water from the creek.

Three days were devoted to an examination of the creek and only four species of fishes were obtained.

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* Report of an examination of the Upper Columbia River by Lieut. Thomas W. Symons, Ex. Doc. 186, 47th Cong. 1st Session.

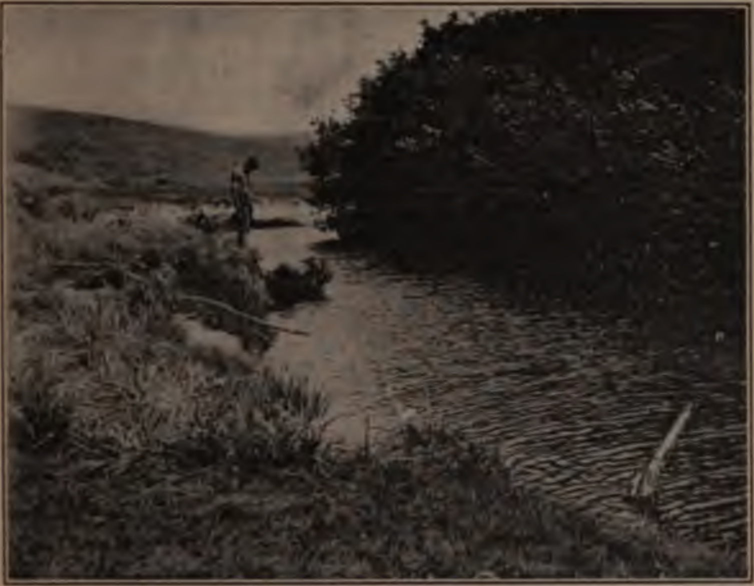


Fig. 1.

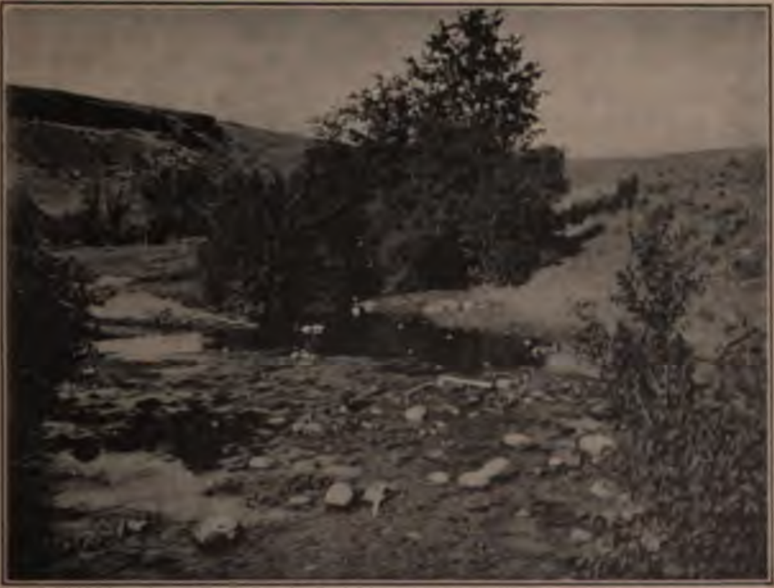


Fig. 2.

Figs. 1 and 2. Crab Creek near Rocky Ford, 12 miles north of Ritzville, Wash. Type locality of *Salmo eremogenes* Evermann and Nichols.

The list is as follows:

1. **Catostomus catostomus** (Forster).

LONG-NOSED SUCKER.

Head 4.5 in length; depth 4.4; depth of caudal peduncle 2.9 in head; eye 6.5; snout 2.2; interorbital width 2.4; dorsal 12; anal 7; scales 18–110–13, between occiput and dorsal about 60.

Width of mouth about 2.8 in length of head; upper lip with about 4 rows of papillæ; lower lip with two rows between apex of cleft and border of lip, and 4 or 5 rows on its lobes.

Ventrals 1.3 in head; pectoral 1.2; origin of dorsal slightly nearer tip of snout than base of caudal; anal reaching past base of outer caudal ray; lateral line complete.

Color (in life).—Above dull yellowish, irregularly blotched with darker; belly white; fins russet brown.

Only one small example (6.3 inches long) was obtained. It agrees perfectly with young of this species from other places.

2. **Leuciscus balteatus** (Richardson).

Common, but only a few young individuals retained.

3. **Salmo eremogenes** Evermann & Nichols, sp. nov.

Type, No. 62960, U. S. N. M., a specimen 10 inches long, obtained by R. Lhamon, in Crab Creek at Rocky Ford, north of Ritzville, Washington, July 30, 1908.

Head 4.3 in length; depth 3.6; eye 5.2 in head; snout 4.2; maxillary 1.95; mandible 1.6; least depth of caudal peduncle 2.5; longest dorsal ray 1.75; longest anal ray 1.9; ventral 1.8; pectoral 1.6; adipose fin 5; caudal 1.4; dorsal rays 11; anal 10; pectoral 15; ventral 9; scales 32-165–32; gillrakers 19; branchiostegals 12 or 13. Teeth on jaws, palatines and vomer, and large teeth on tongue.

Body robust, the back rather strongly elevated; head large, snout blunt, lower jaw slightly projecting; maxillary long and rather broad, its middle under pupil; eye large; caudal peduncle stout.

Color (in life).—Above dark olive; caudal peduncle with numerous close-set roundish black spots of moderate size, these spots becoming less numerous anteriorly, there being only a few in front of dorsal and none on head; dorsal and caudal fins with black spots, other fins immaculate, the spots on anterior part of body more nearly round than those on caudal peduncle; cheek and opercle olive yellowish, tinged with pink; lower part of side from base of pectoral to anal more or less pink, the color showing a little on pectoral and more on ventrals; ventral surface whitish; pectoral green; anal olive with more or less reddish tint; ventrals more or less olive, tinged to a considerable extent with the pink of the flanks; red on lower jaw quite distinct.

In spirits the pink or rosy of sides and the red on lower jaw have faded.

A cotype, No. 5370, Bureau of Fisheries, 7 inches long, and taken at same place, agrees essentially with the type. Scales about 175.

Color (in life).—Olive, becoming golden on lower part of side which is tinged with silvery; back, dorsal and caudal with large black spots becoming fewer towards head; pectoral, ventral and anal reddish olive, a bright brick-red streak on lower jaw; belly white.

Another cotype, 5.75 inches long, from same place had the scales about 33–174–31.

Color (in life).—Olive green above, a bright red stripe along lower jaw; about 4 roundish red blotches near the center of lateral line; black spots on back, dorsal and caudal, becoming fewer towards head, the spots not so numerous as in the other cotype, pectorals yellow; ventrals dull yellow with a white outer edge; anal with a reddish and olive tint and white front outer margin.

A small example, 2.15 inches long from same place, gives the following measurements:

Head 3.7 in length; depth 4.2; eye 2.6 in head; snout 4.5; maxillary 2; least depth of caudal peduncle 2.5. Anal rays 10.

Color (in life).—Olive above with small black spots; belly white; pectoral, ventral, anal, and caudal fins dull yellow; about 8 or 9 rather broad parr marks; caudal dusky at base; yellow stripe at base of branchiostegals; dorsal dull yellowish, somewhat marked with dusky at base, tip and front margin; adipose fin pale dull yellowish with a dark tip and fine dark punctulations.

We note with great interest that fingerling fish (the colors of one of which were carefully noted and a number of which were examined for this mark) have the red cut-throat mark of the adult already indicated as a yellow streak at the base of the branchiostegals.

The Crab Creek trout is evidently a species of the cut-throat series. Red marks on throat are very distinct, and the scales are small, there being 165 to 175 in a longitudinal series.

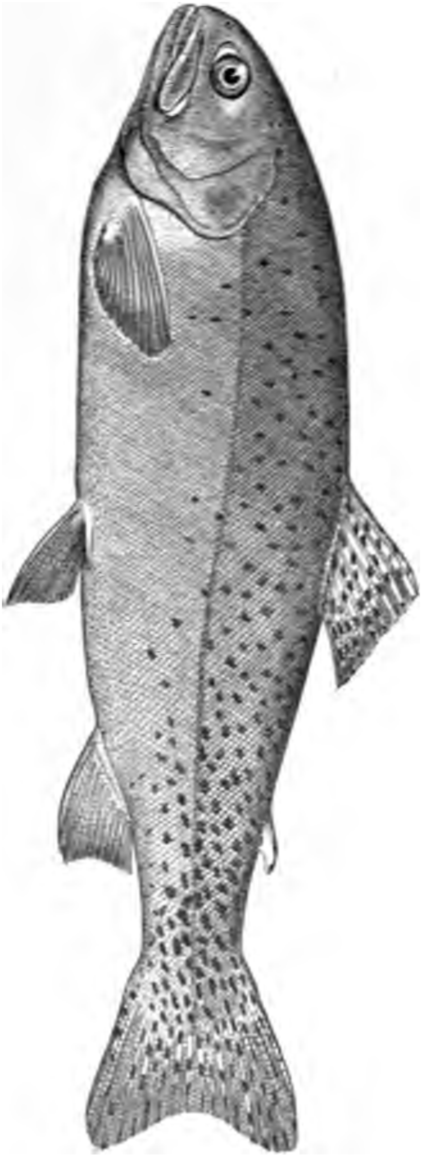
As regards coloration, the Crab Creek fish have the spots, which are large, and vary in abundance, much the most abundant caudally. The spots are mostly on the caudal peduncle, the back as far forward as the first dorsal fin, and the dorsal and caudal fins. In each specimen, however, few spots occur in the front part of the body.

In the number, size and arrangement of the spots, this species most resembles *Salmo stomias*, the trout of the headwaters of the Platte and Arkansas. It differs from that species, however, in the shorter snout, larger eye and the somewhat larger scales. The Waha Lake trout (*S. bouvieri*) differs from the Crab Creek species in the entire absence of black spots anteriorly.

4. **Cottus punctulatus** (Gill).

WESTERN BLOB.

Very abundant, though only a few small specimens were secured.



Salmo eremogenes Evermann & Nichols. Type.

VOL. XXII, PP. 95-104 JUNE 25, 1909

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

NOTES ON SOME FISHES FROM THE CANAL ZONE.*

BY BARTON WARREN EVERMANN AND
EDMUND LEE GOLDSBOROUGH.

Mr. August Busck of the Division of Entomology, U. S. National Museum, spent several weeks in the Canal Zone in the early part of 1907, studying the mosquitoes of that region. These studies naturally led him to make some observations on the fishes, particularly the smaller freshwater species, with reference to their feeding habits. Specimens of a number of species were collected and preserved and later turned over to the Bureau of Fisheries for identification.

Later (in 1908), at the instance of Mr. Busck, a second considerable collection was received from Mr. Allan H. Jennings, Office Chief Sanitary Inspector, Ancon, Canal Zone.

The localities represented in the collections made by Mr. Busck are as follows:

1. *Rio Boqueron.* This stream is one of the headwaters of the Chagres River. It was examined at a point in Colombia near the coast and about 40 or 50 miles from the Canal Zone. At that place the Boqueron is a small stream not over 40 feet wide and never getting much wider, although subject to great and sudden floods. At one time it rose 9 feet in 2 hours.

Dynamite was used in collecting in this stream, in which small fishes were very abundant. Mr. Busck collected at this place in May, 1907.

2. *Taboga Island.* This island is on the Pacific side about 10 to 15 miles due east from Panama.

The specimens from this place were obtained from tidepools July 4, and all belong to saltwater species.

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3. *Tabernilla.* This is a small town in Atlantic drainage, about midway between the Atlantic and Pacific coasts. The specimens obtained here are all from a small stream not more than 2 feet wide rising in a small spring which was full of leaves and small fishes. When a quantity of water was dipped up from the spring there was quite as much leaves and fishes as water. Mosquito larvæ were abundant and seemed to be living amicably with the fishes; the fish did not seem to be eating the larvæ or the mosquitoes. Collections were made by Mr. Busck at this place.

The collections by Mr. Jennings were made at Tabernilla in January and July, at Gorgona and Paraiso in February, and at Caldera Island, Porto Bello Bay, in January, March, and April, all in 1908.

The specimens of *Gambusia episcopi*, *Pœcilia sphenops*, and *Agonostomus monticola* from Caldera Island were taken from a small mountain brook.

The construction of the Panama Canal is a matter of great importance to students of the geographic distribution of animals and plants. The completion of the canal will establish a permanent waterway and means of communication between the Atlantic and Pacific coasts of America, which in time is sure to affect very materially the geographic distribution of many of the species of aquatic animals and plants in that region. It is highly probable that in time many, if not all, of the brackish water species of fishes and crustaceans and other invertebrates of that region will find their way through the canal from one side to the other; and it is not at all improbable that some purely saltwater species will pass from one side to the other.

But of still greater importance are the changes in the animal and plant life which will result from the construction of the Gatun Dam and the formation of Gatun Lake. This lake or reservoir will cover many square miles of territory now entirely out of water, and consisting of hills and valleys, and canyons and small plains, through and among which run a number of large rivers, such as the Rio Chagres, Rio Trinidad, Rio Gatun, and a great number of smaller streams. Practically all of these streams will be wiped out of existence when the land through which they now flow becomes converted into the proposed large lake. Some of the aquatic species inhabiting them will be wiped out of existence, and even those which are not exterminated will have their geographic distribution seriously affected and their habits more or less changed. It is a source of great regret to biologists that the Government has not appreciated the necessity for a thorough biological survey of the Canal Zone before the completion of the canal. It is not yet too late to make such a survey, but it must be made before the canal is completed; else problems which can now be solved will then remain forever unsolved.

The collection of fishes upon which this paper is based, although small, is nevertheless of considerable importance, and it is highly desirable that the facts gained from their study be put on record.

FAMILY CHARACINIDÆ.

THE CHARACINS

1. **Astyanax æneus** (Günther).

Seven specimens, 40 to 47 mm. long, from Tabernilla, January 15.

Ten specimens, 65 to 105 mm. long, from Rio Boqueron.

2. **Astyanax fischeri** Steindachner.

Twenty-five specimens, 35 to 63 mm. long, from Tabernilla, July 24.

Three specimens, 55 to 63 mm. long, from a small pool at Paraiso, February 1.

These two species are doubtfully distinct. *A. fischeri* seems to differ, however, from *A. æneus* in the slightly larger eye, slightly greater depth, and in the coloration, the former always having a vertical black humeral spot bordered on each side by silvery, and a black caudal spot which does not extend on the caudal rays.

A comparison of our specimens of *A. æneus* with 2 examples of *A. macrophthalmus* from the Rio Tonto, Mexico, kindly sent us by Mr. C. Tate Regan, shows them to be distinct, as evidenced by the slightly larger eye and higher dorsal fin of *A. macrophthalmus*. We are unable to observe any differences in the anal fin.

For purposes of comparison we give comparative measurements of a series of specimens of each of the species, *A. fischeri*, *A. æneus*, and *A. macrophthalmus*.

Astyanax fischeri.

Length in mm.	Head in length	Eye in head	Scales	Dorsal fin	Anal fin		Locality
				Longest ray in head	Formula	Longest ray in head	
63	3.8	2.8	8–33–6	1.1	24	1.6	Paraiso, Canal Zone
57	3.8	2.8	9–34–6	1	24	1.6	“ “
63	3.3	2.6		1.2	23	1.5	Tabernilla “
52	3.4	2.4		1.2	24	1.6	“ “
52	3.4	2.5		1	24	1.5	“ “
51	3.8	2.5		1.2	24	1.6	“ “
49	3.6	2.5		1.1	26	1.6	“ “
43	3.2	2.2		1.2	23	1.6	“ “
40	3.2	2.3		1.2	24	1.6	“ “
38	3.4	2.4		1.2	26	1.6	“ “
37	3.4	2.1		1.2	26	1.8	“ “
35	3.3	2.2		1.2	25		“ “
Astyanax æneus.							
47	3.5	2.8		1	25	1.6	Tabernilla, Canal Zone
46	3.5	2.6		1.1	24	1.5	“ “
45	3.3	2.7		1.2	23	1.5	“ “
45	3.5	2.6		1.1	26	1.8	“ “
44	3.6	2.6		1.2	24	1.6	“ “
40	3.6	2.5		1.1	24	1.7	“ “
90	3.8	3	9–33–6	1.1	24	1.6	Rio Tonto, Mexico
88	4	3.1	9–33–6	1.1	26	1.5	“ “
95	4	3	36	1.2	26	1.5	Taboga Island
86	3.5	3	40	1.2	26	1.6	“ “
76	3.75	2.65	36	1.2	26	1.65	“ “
70	3.75	3	33	1.1	25	1.6	“ “
65	3.75	2.65	35	1			“ “
Astyanax macrophthalmus.							
94	4	2.5	33	1.2	25	1.5	Rio Tonto, Mexico
77	4	2.5	9–33–6	.8	25	1.8	“ “

3. **Cheirodon insignis** Steindachner.

Head 3.8 in length; depth 3; eye 2.6 in head; snout 4; interorbital 1 in eye; dorsal 10; anal 20; scales 6–34–4, 7 pores on right side and 10 on left.

Body short, greatly compressed, the dorsal and ventral outlines nearly evenly arched, the dorsal somewhat the more strongly; head short, snout blunt. Teeth in a single row in each jaw, each with about 5 equal cusps, and two smaller ones differing in this respect very markedly from ***Astyanax*** in which the cusps consist of a central large one with one or two small lateral ones on either side. Scales rather large, lateral line incomplete, the pores usually developed only on 6 to 12 scales. Fins well developed, the height of the dorsal somewhat greater than length of head, that of the anal about 1.5 in head. Color in alcohol, silvery straw-color above, plumbeous on middle of side, lower parts pale; a large black spot on caudal peduncle at base of caudal fin, followed by a pale area, the black not extending to caudal rays.

The above description from a specimen 39 mm. long from a small running ditch at Tabernilla, where it was obtained July 24, 1908,. by Mr. Allan H. Jennings. Seventeen others taken at the same time and place, measure from 30 mm. to 40 mm. and agree in all essential respects. The number of pores in the lateral line varies from 6 to 12, the most usual number being 10.

Cheirodon insignis Steindachner, Zur Fisch—Fauna des Cauca und der Flüsse bei Guayaquil, 22, fig. 3, pl. VI, 1880, Cauca River, United States of Colombia.

4. **Cheirodon gorgonæ** Evermann & Goldsborough, sp. nov.

Type, No. 64094 U. S. National Museum, a specimen 28 mm. long, collected February 7, 1908, by Mr. A. H. Jennings, from a small seepage pool below the spillway of the reservoir dam at Gorgona, Canal Zone.

Head 3.7 in length; depth 3.14; eye 2 in head; longest dorsal ray 1 in head; longest anal ray 1.57 in head; dorsal II, 10; anal II, 17; scales in longitudinal series 29+4, pores on 8 of them, 10 scales in cross series from front of anal upward and forward to origin of dorsal; 13 scales in front of dorsal.

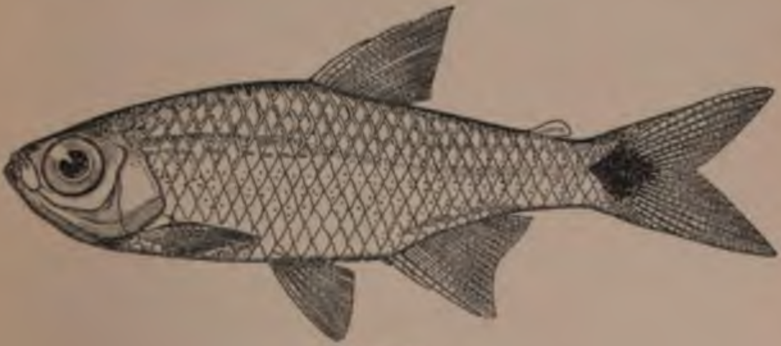

Figure 1.
Cheirodon gorgonæ Evermann & Goldsborough. Type.

Body short, compressed; dorsal and ventral outline evenly arched; head short; snout blunt; mouth small, oblique, maxillary reaching eye; teeth in a single row in each jaw, each evenly convex, with a large central cusp and 3 graduated smaller ones on either side, differing in this respect from *C. insignis*, which has the five central cusps of about equal size with one smaller one on either side, the outer edge being not nearly so arched as in the present species. Scales moderate, lateral line incomplete, it being developed on only 8 scales in the type, but varying in other specimens from 8 to 13; fins all well developed.

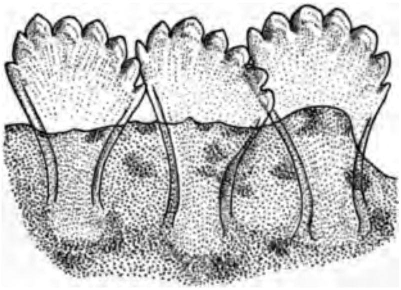

Figure 2.
Teeth of *Cheirodon insignis.*

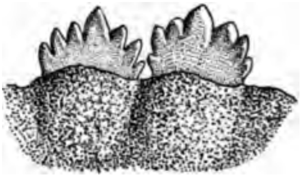

Figure 3.
Teeth of *Cheirodon gorgonæ.*

General color, reddish brown, this appearance due to the reddish brown punctulations at the posterior edge of the scales, these punctulations more numerous and giving the fish a somewhat darker appearance on the entire part of the body above the median line, and on the posterior part of entire body from origin of anal; centers of scales light, except those between ventral and pectoral fins and median line, where the scales have a silvery reflection; a very dark oval or nearly round spot, about the size of eye, on last scales at base of caudal and extending slightly beyond the scales on to the rays of the caudal; fins with some reddish brown body color, growing lighter toward tips where there are indications of dark punctulations; a narrow darkish lateral stripe, growing silvery anteriorly.

This species is very closely related to *C. insignis*, but differs in the very peculiar teeth, the larger eye, the fewer anal rays and the slightly shorter dorsal ray.

COMPARATIVE MEASUREMENTS OF 3 SPECIMENS OF *Cheirodon insignis* AND 6 OF *Cheirodon gorgonæ.*

Length in mm.	Head in length	Depth in length	Eye	Dorsal fin		Anal fin		Locality
				Formula	Longest ray in head	Formula	Longest ray in head	
C. insignis								
35	3.8	3	2.5	10	.8	22	1.5	Tabernilla, Canal Zone
39	3.8	3	2.6	10	.8	21	1.8	"
31	3.6	2.8	2.5	10	.8	21	1.4	"
C. gorgonæ								
25	3.8	3.1	2.2	10	1.	19	1.4	Gorgona, Canal Zone
26	3.7		2.3	10	1.	18	broken	"
30	3.8	3.1	2.40	10	broken	18	"	"
*28	3.7	3.14	2.45	10	1.	17	1.57	"
27	3.6	3.2	2.3	10	1.	17	broken	"
26	3.5	3	2.25	10	1.	19	1.6	"

* The type.

We have also 11 cotypes, all collected by Mr. Jennings at the same time and place as the type. One of these has been sent to Mr. C. Tate Regan of the British Museum, one to Dr. C. H. Eigenmann of Indiana University, one to the Museum of Stanford University, and one to the Field Museum of Natural History. Of the remaining 8, 5 are in the U. S. National Museum, and 3 in the Reserve Series of the Bureau of Fisheries as No. 5421.

5. **Brycon striatulus** (Kner).

Seven specimens ranging in length from 2.5 to 4 inches, from Rio Boqueron.

Dorsal 10; anal 36; scales about 70.

6. **Rœboides guatemalensis** (Günther).

Ten specimens, 3⅝ to 5 inches long, from Rio Boqueron and 9, 2.5 to 4 inches long, from a running ditch at Tabernilla.

Dorsal 10; anal 48; scales 78 to 80.

Family SYMBRANCHIDÆ.

THE SYMBRANCHOID EELS.

7. **Symbranchus marmoratus** Bloch.

One specimen, 8 inches long, from Rio Boqueron.

Family ANGUILLIDÆ.

THE EELS.

8. **Anguilla rostrata** (Le Sueur).

COMMON EEL.

Three examples, 2.5 to 3.75 inches long, from Caldera Island, Porto Bello Bay.

Family PŒCILIIDÆ.

THE KILLIFISHES.

9. **Rivulus godmani** Regan.

One specimen, 1¾ inches long, collected by Mr. Busck in a small stream at Tabernilla.

Head 4 in length; depth 5.14; eye 2.75 in head; snout 4.5; dorsal 7; anal 12; pectoral 12; scales 36, 25 before dorsal.

This specimen differs from any description we can find of any *Rivulus* in having no ventral fins. Since one of the ventral fins is sometimes absent in members of this family and we have but the single specimen, we hesitate to separate it from *godmani* which it otherwise seems to be.

A very interesting structure in this specimen is the "cyclopean eye" in the center of the occiput. It consists of a large round scale-like formation, as large as eye, with radiating striæ. We can find no reference to such a structure nor anything like it in specimens of many genera that we have examined.

10. **Gambusia episcopi** Steindachner.

Two female specimens, 2 and 2¾ inches long, from a small mountain brook on Caldera Island, Porto Bello Bay, January 24, 1908. These are fine specimens showing very distinctly the dark spot on middle anal base. Each has many eggs with the young, fairly well developed, curved around the yolk and fully formed.

Twenty-nine specimens, ⅞ to 1½ inches long, from reservoir stream, Caldera Island, Porto Bello Bay, April 9, 1908. All of these but four have the prolonged anal fin. The smallest of these four is 1 inch long. In all the others the first 3 or 4 anal fin rays are produced and show a white color in alcohol, behind which is the dark falcate spot extending nearly to tip of fin.

Dorsal 8; anal 9; scales 27; teeth fixed, in a narrow band, no large ones.

11. **Pœcilia sphenops** Cuvier & Valenciennes.

Six specimens, ¾ to 1¼ inches long, from a small stream at Tabernilla, agreeing well with current descriptions.

Four specimens, 1¾ to 2½ inches long, from Caldera Island, Porto Bello Bay. The smallest one of these is a male. The others are females, the largest of which had many well-developed young, one of them being ⅝ of an inch long.

Three females, each about 1½ inches long, from a small mountain stream on Caldera Island.

Thirty-five specimens, ⅝ to 2½ inches long, from Paraiso.

Twenty-five specimens, ⅞ to 2 inches long, from a small seepage pool below spillway of reservoir dam at Gorgona. In these specimens and those from Paraiso there seems to be but a single row of teeth in each jaw, an outer row of movable conic teeth; if there are smaller teeth behind this row they are most minute and invisible with a good lens.

Fifty specimens, ¾ to 2¼ inches long, from Tabernilla, January 15, 1908.

Five specimens, ¾ to 1⅝ inches long, from Tabernilla, and 12 specimens, 1 to 2 inches long, from Rio Boqueron.

One example, a female 2 inches long, contained 60 young developed sufficiently to show the eyes plainly. This species is evidently viviparous.

Dorsal 9; anal 7; scales 28 to 30; teeth very small, conical, in a single row or very narrow band, movable.

Family ARGENTINIDÆ.

THE SILVERSIDES.

12. **Thyrina pachylepis** (Gill).

One specimen, 2 inches long, from Rio Boqueron.

Panama is the type locality of this species.

Family MUGILIDÆ.

THE MULLETS.

13. **Agonostomus monticola** (Bancroft).

Two specimens, 3¼ and 3½ inches long, from a small mountain brook on Caldera Island.

Dorsal IV, 8; anal 9; scales 38.

FAMILY POLYNEMIDÆ.

THE THREADFISHES.

14. **Polydactylus approximans** (Lay & Bennett).

Four specimens, ⅜ to 1⅜ inches long, from Taboga Island.

FAMILY CICHLIDÆ.

THE CICHLIDS.

15. **Æquidens cæruleopunctatus** (Kner & Steindachner).

Fourteen specimens, 1½ to 4¼ inches long, from Tabernilla.
Nine specimens, 1⅛ to 2 inches long, from Rio Boqueron.
Dorsal XV, 10; anal III, 7; scales 25.

FAMILY TEUTHIDIDÆ.

THE TANGS.

16. **Teuthis crestonis** Jordan & Starks.

Three young examples from Taboga Island.

FAMILY BALISTIDÆ.

THE TRIGGERFISHES.

17. **Balistes naufragium** Jordan & Starks.

One young example from Taboga Island.

FAMILY TETRAODONTIDÆ.

THE PUFFERS.

18. **Spheroides annulatus** (Jenyns).

Five young examples from Taboga Island.

FAMILY GOBIIDÆ.

THE GOBIES.

19. **Mapo fuscus** (Rüppell).

Five specimens, 2⅜ to 4 inches long, from Taboga Island.

20. **Eleotris pisonis** (Gmelin.

Nine specimens, 1¼ to 3½ inches long, from Caldera Island.

VOL. XXII, PP. 105-106 JUNE 25, 1909

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

A NEW CHIPMUNK FROM COLORADO.

BY EDWARD R. WARREN.

In the spring of 1905 I collected a single specimen of a chipmunk at Gaume's Ranch, Shell Rock Cañon, in the northwest corner of Baca County, Colorado, which seemed to belong to an undescribed form. In April of this year (1909) I was successful in collecting two more specimens of the same animal at Irwin's Ranch, in Tp. 29 S., R. 52 W., Las Animas County, Colorado, about twelve miles due west of the other locality.

The region where these animals were found is at an elevation of 5,000 feet and a little more, a sandstone mesa cut up by many gulches and shallow cañons, and covered with "cedar" (juniper) and piñon trees; locally it is known as "The Cedars." It is a very dry region, with practically no running streams and but few springs and water-holes. Evidently as a result of this dryness the colors of the animal are very pale and apparently faded, but an examination of the pelage of the specimens shows it to be practically unworn, and as the three at hand are quite identical in color and other characteristics I have no hesitation in describing it as a subspecies of *Eutamias quadrivittatus*, to which it is evidently closely allied, though differing much in color.

Eutamias quadrivittatus animosus subsp. nov.

LAS ANIMAS CHIPMUNK.

Type from Irwin's Ranch, Tp. 29 S., R. 52 W., Las Animas County, Colorado (elevation 5,000 feet). No. 3428, collection of E. R. Warren. ♀ adult. April 29, 1909. E. R. Warren. (This will be deposited in the U. S. National Museum.)

Characters.—Size as in *quadrivittatus*, possibly a little larger. The animal has a very pale rusty appearance, and the three specimens in my possession are so much paler than a large series of typical *quadrivittatus* that there is no comparison to be made between them.

There are no cranial characters to distinguish it from *quadrivittatus*.

Color.—All colors pale. Inner pair of light stripes grayish white, outer pair quite clear white. Middle dark stripe narrow, blackish, pale chestnut or rufous bordered. Inner pair of dark stripes rather pale chestnut rufous, darkest posteriorly, with a little blackish; outer pair a pale shade of the same, not very distinct from the color of the sides, which are pale yellowish rufous. Post-auricular spot large and whitish. Top of head and shoulders quite gray. Dark facial stripes narrow and blackish, not clearly black. Flanks grayish. Upper surface of tail with less black and more rusty than in typical *quadrivittatus*, under surface of tail pale bright rufous, not the dark chestnut of *quadrivittatus*.

Measurements.—Type specimen: Total length, 247; tail vertebræ, 115; hind foot, 37. A male topotype measures 247; 105; 35.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NEW CRABS FROM THE GULF OF SIAM.*

BY MARY J. RATHBUN.

The forms here described are part of a collection made by Dr. Theodor Mortensen in the Gulf of Siam in 1899–1900. A full report with illustrations will be published in Det Kongelige Danske Videnskabernes Selskabs Skrifter. The type specimens are in the Museum at Copenhagen.

FAMILY LEUCOSIIDÆ.

SUBFAMILY LEUCOSIINÆ.

Heteronucia mesanensis sp. nov.

Type.—♀, between Koh Mesan and Koh Chuen, 15 fathoms.

Dimensions.—Length, 3.7 mm.; width, 4.5 mm.

Carapace covered with vesiculous granules, subglobular, very uneven; cardiac and mesogastric regions set off by a deep groove; branchial region nodulous. On the pterygostomian region a large obtuse-angled prominence in line with the eye. Front and orbits nearly one-half as wide as carapace; front with a median furrow and faintly bidentate. Outer maxilliped bent almost at a right angle near its middle. Chelipeds knobby, palm very thick proximally, as long as fingers which are evenly denticulate and overlap, dactylus lying within pollex.

Cryptocnemus mortenseni sp. nov.

Type.—♂, Koh Chuen, 30 fathoms, shell bottom.

Dimensions.—Length, 3 mm.; width, 3.8 mm.

Near *C. pentagonus* Stimpson. Margin of posterior half of carapace regularly arched; of anterior half slightly angled at hepatic region; edge of front arcuate. Carapace surrounded by a thin striated rim, widest at postero-lateral region, and continued downward to anterior margin of buccal cavity, forming lower margin of a facet, of which upper edge is blunt. Chelipeds with striated marginal crests; palm $1\frac{1}{4}$ times as long as wide; immovable finger broadly triangular, sharp-pointed; dactylus strongly bent down.

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* Published with the permission of Dr. Theodor Mortensen.

Philyra olivacea sp. nov.

Type.—♂, coast of Lem Ngob, in seine.

Dimensions.—Length, 9 mm.; width, 7.8 mm.

Carapace elongate oval, hepatic facet well defined; elevated portions granulate; from the postero-lateral margin 2 oblique lines run inward and converge, forming a small triangular area. Front subtruncate, a slight median point; end of maxillipeds visible from above. Eyes long, slender. Strong tooth on lower hepatic margin. Lateral margins of carapace bi-angular. Posterior margin trilobate. Chelipeds granulous, hand ⅔ as wide as long, outer edge straight, inner convex; dactylus ¼ longer than outer edge of palm. Third, fourth and fifth segments of abdomen fused, penultimate segment unarmed, wider than terminal half of preceding segment.

SUBFAMILY ILIINÆ.

Arcania siamensis sp. nov.

Type.—♀, Sound at Koh Chang, 3–5 fathoms, soft clay.

Dimensions.—Length with spine, 17.5 mm.; without spine, 15.7 mm.; width with spines, 24.5 mm.; without spines, 15.5 mm.

Near *A. septemspinosa* (Fabricius); carapace more globular, branchial regions more swollen; surface densely covered with granules visible to naked eye; marginal spines shorter, the long lateral spine less than ⅓ width of carapace.

FAMILY HYMENOSOMIDÆ.

Rhynchoplax coralicola sp. nov.

Type.—♀, Singapore, on coral reef.

Dimensions.—Length, 2.2 mm.; exclusive of rostrum, 1.8 mm.; width, 1.7 mm.

Shell thin, spotted with fine black dots, sparingly hairy, ovate, bordered by a raised rim; only one lateral spine, situated on antero-lateral margin. Rostrum, a long median and two short lateral spines. Chelipeds unarmed, fingers as long as palm. Dactyli of legs spinulous.

FAMILY OCYPODIDÆ.

SUBFAMILY MACROPHTHALMINÆ.

Cleistostoma lingulatum sp. nov.

Type.—♀, Lem Ngob, in mangrove swamp.

Dimensions.—Length, 3.1 mm.; width, 4.5 mm.; width of front, 1.3 mm.

Surface setose, setæ retaining mud, granules forming clumps and thickened lines on elevated parts. Front almost vertical, with 2 transverse, oval, concave surfaces. Upper border of orbit very oblique. Median tooth of epistome long and lingulate. Exognath concealed; merus of endognath very narrow anteriorly and with a deep outer sulcus. Legs subcylindrical, with one or two tubercles on their anterior margin.

Family GRAPSIDÆ.

Subfamily VARUNINÆ.

Camptandrium paludicola sp. nov.

Type.—♀, mangrove swamp, Lem Ngob.

Dimensions.—Length, 4.3 mm.; width, 5.3 mm.

Surface uneven, regions ornamented with a few tubercles regularly placed. Width of front ⅓ greatest width of carapace. Three large antero-lateral teeth, and a minute tooth behind the last. Chelipeds subcylindrical, subterminal spine on arm. Fingers as long as palm, broadly hollowed at tips. Merus joints of legs dilated, a triangular spine on distal third of anterior border.

Acmæopleura rotunda sp. nov.

Type,—♂, south of Koh Kut, 17–20 fathoms, mud.

Dimensions.—Length 2 mm.; width 1.75 mm.; fronto-orbital width, 1.7 mm.; width of front, 0.7 mm.

Carapace subcircular, widest at middle; front bilobed; eyes stout, filling orbits. Maxillipeds not gaping, merus and ischium subequal to each other in length and width, but much wider than long; exognath narrow. Legs narrow, unarmed, dactyli very slender, moderately curved.

Subfamily SESARMINÆ.

Sesarma (Chiromantes) siamense sp. nov.

Type.—♀, Koh Kut, stony coast.

Dimensions.—Length, 8.5 mm.; anterior width, 9.5 mm.; posterior width, 9.7 mm.; width of front, 5.1 mm.

Lateral tooth slight, obtuse-angled. Middle pair of superior lobes of front distinctly wider than outer pair. A slight obtusangular expansion on anterior margin of arm. Palm striated on upper surface, 2 striæ sharply marked, 5 or 6 spinules on upper edge of dactylus on proximal ⅓. A sharp subdistal spine on merus-joints of legs, last three joints sparsely furnished with long fine hairs.

Family PINNOTHERIDÆ.

Subfamily PINNOTHERINÆ.

Pinnotheres bürgeri sp. nov.

Type.—♀, Koh Kram, 30 fathoms.

Dimensions.—Length, 2 mm.; width, 2 mm.

Near *P. gracilis* Bürger. Carapace nearly circular, front little advanced, orbits cut out of margin, eyes unpigmented. Chelipeds with lower margin of propodus concave below distal end of palm; fingers tapering pretty regularly to the strongly curved tips; a slight basal prominence on each finger.

Pinnotheres lanensis sp. nov.

Type.—♀, Koh Lan, 30 fathoms, mud.

Dimensions.—Length, 2.4 mm.; width, 2.7 mm.

Allied to *P. parvulus* Stimpson. Carapace very thin, with an antero-lateral angle. Orbits invisible from above; eyes pigmented. Last two segments of endognath mitten-shaped, dactylus small, attached half-way back on propodus, and reaching its terminal fifth. Chelipeds stout, palm widening distally, pollex wider at base than dactylus. Legs, third longest, second next, first and fourth subequal; dactyli of third and fourth pairs longest, equal.

Pinnotheres quadratus sp. nov.

Type.—♀, Koh Chang, one fathom, coral.

Dimensions.—Length, 5.2 mm.; breadth, 5.3 mm.

Near *P. palaensis* Bürger. Carapace subquadrate, with rounded corners. Orbits ventral, eyes pigmented. Propodus of maxilliped large, spatulate, overreaching inner angle of merus; dactylus small, linear, scarcely visible when maxillipeds are folded in place. Cheliped stout, widening distally, more than twice as long as high, and twice as long as fingers; a large tooth near base of dactylus fits between two smaller teeth on pollex. Legs, third longest, fourth next, second next; third and fourth dactyli longest, subequal, first and second subequal.

Pinnotheres nigrans sp. nov.

Type.—♀, Koh Lan.

Dimensions.—Length, 6.8 mm.; width, 8.3 mm.

Allied to *P. latus* Bürger. Carapace very high in the middle; anterior margin advanced at middle; orbits invisible in dorsal view; corneæ black. Dactylus of endognath does not reach end of propodus, which tapers toward the end. Cheliped not much stouter than legs, palm widest at distal end, margins nearly straight, 1⅙ times as long as fingers. Legs nearly of a length, third longest, second and fourth next, subequal; dactyli of third and fourth pairs longest, equal, twice as long as the others.

Pinnotheres kamensis sp. nov.

Type.—♂, west of Koh Kam, 5 fathoms.

Dimensions.—Length, 1.4 mm.; width, 1.5 mm.

Carapace ovate, an antero-lateral angle; surface coarsely punctate; front strongly advanced, bilobed; eyes large, orbits in margin of carapace; corneæ black. Inner margin of merus of endognath angled; propodus long and narrow; dactylus inserted behind middle of propodus, and not reaching end of same. Chelipeds short and stout, fingers gaping widely. Legs broad, first 3 pairs subequal, last pair smaller; same is true of the strongly curved dactyli.

Pinnotheres kutensis sp. nov.

Type.—♂, south of Koh Kut, 17–20 fathoms, mud.

Dimensions.—Length, 1.1 mm.; width, 1.02 mm.

Carapace oblong-hexagonal, transparent; front advanced, subtruncate, eyes large, projecting beyond carapace. Palpus of endognath reaches a little beyond angle of merus; propodus short, broad, with dactylus articulating near its middle and overreaching it. Hands inflated, fingers slender, gaping. Legs, second longest, third next, first next; dactyli, fourth shortest, others subequal.

Pinnotheres siamensis sp. nov.

Type.—♂, south of Koh Kut, 17–20 fathoms, mud.

Dimensions.—Length, 1.1 mm.; width, 1.05 mm.

Near *P. kutensis*. Carapace more strongly angled behind orbit, surface deeply punctate; front plainly bilobed. Propodus of endognath very elongate, dactylus attached on distal half of propodus not far from middle, and reaching end of propodus. Sternum hollowed out in a circular depression in which lies the end of the abdomen. Palms much swollen. Carpal and propodal segments of legs widened in distal half; dactyli subequal.

SUBFAMILY PINNOTHERELINÆ.

Mortensenella gen. nov.

Dorsal aspect of *Pinnixa*. Maxillipeds filling buccal cavity, ischium-merus broad, longitudinal, the two segments subequal, subquadrate, fused, but with a faint suture line; palpus small, attached near outer angle of merus, three segments end to end. Exognath exposed and of good size.

Type and only species.

Mortensenella forceps sp. nov.

Type.—♂, Koh Chang, outside mangroves.

Dimensions.—Length, 4.2 mm.; width, 6.8 mm.; fronto-orbital width, 2.8 mm.; edge of front, 1.3 mm.; posterior margin, 4.6 mm.

Edge of front straight; lateral angles of carapace rounded; lateral margins crenulate, with closed fissures. Chelipeds equal; fingers strongly curved away from each other, making a wide gap; a truncate tooth at middle of dactylus. Abdomen narrow-triangular, fifth segment constricted at middle; appendages of first segment would exceed abdomen if extended, but they are bent sharply backward opposite posterior margin of first sternal segment, their extremities broadly oval.

SUBFAMILY ASTHENOGNATHINÆ.

Asthenognathus hexagonum sp. nov.

Type.—♀, north of Koh Kong, 8 fathoms, mud.

Dimensions.—Length, 5.6 mm.; width, 7.8 mm.; fronto-orbital width, 4.3 mm.; width of lower edge of front, 1.7 mm.

Carapace strongly hexagonal. Front advanced, edge straight, sides oblique. Second leg longest, about twice as long as carapace, and only slightly longer than third leg; first much smaller; fourth most feeble, reaching little beyond merus of preceding pair.

FAMILY GONOPLACIDÆ.

SUBFAMILY CARCINOPLACINÆ.

Litocheira cristata sp. nov.

Type.—♀, two miles south of Koh Tutu, 10 fathoms, sandy mud, shells.

Dimensions.—Length, 5.5 mm.; width, 7.7 mm.; fronto-orbital width, 5 mm.; frontal width, 2.8 mm.

Anterior border of carapace, chelipeds and legs fringed with long hair. Four lateral teeth, of which the third is triangular and prominent. Arm with a thin crest above, forming a tooth near end of segment; wrist eroded; fingers long, cylindrical. Legs with a thin smooth crest on merus, anterior in first three pairs, posterior in fourth pair.

SUBFAMILY RHIZOPINÆ.

Megæsthesius* gen. nov.

Allied to *Camatopsis* Alcock. Eyes unpigmented; movable part of antennules immensely stout; buccal cavern anteriorly narrowed and arcuate, outer maxillipeds closing the cavity; ischiognath as broad as long and broader than merognath, which is subtriangular and bears the palp at its summit; exognath short and narrow.

Type and only species,

Megæsthesius sagedæ sp. nov.

Type.—♂, Singapore, 2–3 fathoms.

Dimensions.—Length, 2.7 mm.; width, 2.7 mm.; frontal-orbital width, 1.8 mm.; width of front, 0.6 mm.

Carapace pentagonal; postero-lateral borders long, parallel; antero-lateral borders short, in line with orbits; front bilobed, lobes arcuate. Antennæ slender, crowded by the antennules away from the front. Chelipeds shorter than legs; palm spinulous below; fingers cylindrical, longer than palm. Legs long, narrow, margins spinulous. Third to fifth segments of abdomen fused.

SUBFAMILY TYPHLOCARCINOPSINÆ nov.

Characters of

Typhlocarcinops gen. nov.

Differs from *Typhlocarcinus* Stimpson chiefly in having the first segment of the male abdomen very broad, covering the whole width of the sternum, and transversely grooved. Remainder of abdomen narrow.

Type and only species,

Typhlocarcinops canaliculata sp. nov.

Type.—♂, between Koh Mesan and Cap Liant, 5–8 fathoms, sand, stones.

Dimensions.—Length, 2.7 mm.; width, 3.6 mm.; fronto-orbital width, 2 mm.; frontal width, 0.9 mm.

Carapace widest posteriorly, lateral margins granulate, entire. Front widening anteriorly, strongly deflexed, lower margin arcuate and faintly emarginate. Orbits circular, eyes slightly pigmented. Buccal cavity with sides parallel; antero-external angle of merognath not produced. Chelipeds about 1½ times as long as carapace; second and third legs subequal, second longest.

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* *μέγας*, great; *αισθησις*, perception by feeling.

SUBFAMILY HEXAPODINÆ.

Thaumastoplax orientalis sp. nov.

Type.—♂, north of Koh Kut, 10 fathoms.

Dimensions.—Length, 9 mm.; width, 12.6 mm.; width across front and orbits, 5 mm.; greatest width of front, 2.8 mm.

Carapace longitudinally very convex, transversely very level; lateral borders marked by a raised line; antero-lateral margin angularly arcuate, postero-lateral margins subparallel; posterior margin convex. Front posteriorly constricted, anterior margin concave, a shallow median tooth. Epistome obsolete in the middle. Propodus of endognath as wide as long. Chelipeds short, stout. Second leg much larger than first and third which are subequal. Third and fourth segments of abdomen fused, also fifth and sixth; appendages of first segment much longer than the abdomen, but doubly recurved, forming together a figure 8.

Thaumastoplax chuenensis sp. nov.

Type.—♂, Koh Chuen, 30 fathoms, shell bottom.

Dimensions.—Length, 3.6 mm.; width, 4.8 mm.; width across front and orbits, 2.5 mm.; greatest width of front, 1.5 mm.

Differs from the preceding in narrower carapace, gastric region sharply outlined; antero-lateral margin less angled, fronto-orbital distance greater, front wider, epistome complete, legs narrower.

Lambdophallus anfractus sp. nov.

Type.—♂, off Koh Kut, 6 fathoms.

Dimensions.—Length, 4.7 mm.; width, 7.3 mm.

Carapace subquadrilateral; anterior angles rounded; convex in both directions. Front nearly vertical, subtruncate. Orbits oblong-oval. Eyes almost immovable, pigmented. Buccal cavity narrows anteriorly; inner margin of ischium-merus so convex that the space between ischium-joints is nearly filled by the palpi. First segment of sternum with a transverse sinuous trench for the projecting extremities of the abdominal appendages. Third to fifth segments of abdomen completely fused, sixth segment nearly as long as wide, seventh segment subtriangular with convex sides.

FAMILY XANTHIDÆ.

SUBFAMILY MENIPPINÆ.

Pilumnus borradailei sp. nov.

Type.—♂, Koh Chang, 1 fathom, coral.

Dimensions.—Length, 7.4 mm.; width, 10 mm.; fronto-orbital width, 7.1 mm.; width of front, 3.5 mm.

Carapace flattened; a fringe of long hairs on anterior border; antero-lateral regions a little granular. Lobes of front very oblique, convex. Superior orbital fissures small, outer notch broad. Four antero-lateral lobes, gradually diminishing in size. Palms covered with pearly granules; only distal half of fingers is dark colored. Nearest to *P. pilosus* Fulton and Grant.

Actumnus changensis sp. nov.

Type.—♀, Koh Chang, 1 fathom, coral.

Dimensions.—Length, 3.8 mm.; width, 5.7 mm.

Near *A. tomentosus* Dana. Frontal and antero-lateral regions dotted with separated granules; an indistinct line of granules curves inward and forward from the last lateral tooth. Surface almost bare, with occasional hairs which do not disguise the markings. First antero-lateral tooth truncate, second and third acute; postero-lateral margins straight. Chelipeds very unequal, granules small, bead-like, dense on palms; larger pollex short, with four large teeth.

Heteropanope sexangula sp. nov.

Type.—♀, Gulf of Siam, exact locality not given.

Dimensions.—Length, 5.2 mm.; width, 7 mm.

Form of *H. eucratoides* Stimpson; hexagonal; surface uneven, a transverse ridge on each frontal and protogastric lobe and a few nodules on branchial region. Front strongly deflexed, quadrilobate; four antero-lateral teeth, fourth largest, acute, third minute. Chelipeds unequal; merus with a subterminal spine, wrist nodular, palms granulose except on distal portion of larger one. Legs slender.

NEW NAMES APPLIED TO KNOWN SPECIES.

Uca manii, nom. nov. for *Gelasimus acutus* de Man, Alcock, not *G. acutus* Stimpson, which is synonymous with *U. dussumieri* (Milne Edwards).

Pinnotheres alcocki, nom. nov. for *P. parvulus* de Man, Bürger and Alcock, not *P. parvulus* Stimpson.

Hypocolpus haanii, nom. nov. for *Hypocolpus granulatus* (de Haan) = *Cancer* (*Xantho*) *granulatus* de Haan, 1837, not *Cancer granulatus* Linnæus, 1758.

Portunus (Lupocycloporus) innominatus, nom. nov. for *Neptunus* (*Lupocycloporus*) *gracilimanus* Alcock, not Stimpson.

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NOTES ON THE NARROW-MOUTHED TOADS (*ENGYSTOMA*) AND THE DESCRIPTION OF A NEW SPECIES FROM SOUTHEASTERN TEXAS.

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In 1859 Girard described a narrow-mouthed toad from Rio Seco, Texas, under the name of *Engystoma texense*. Cope and his contemporaries failed to recognize the animal as distinct from *E. carolinense* Holbrook and until quite recently it has been confused with that species.

In 1906 Miss Mary Dickerson* redescribed *E. texense* from a series of living examples from Brownsville and called attention to the fact that it is a very distinct and easily recognizable species.

The present writer was at first inclined to be a little doubtful of the status of *Engystoma texense*, and, in order to fully satisfy himself that the characters which were supposed to distinguish the two species were constant, made an effort to accumulate a sufficient number of examples of *Engystoma* from different localities, that the question might be settled beyond a doubt.

As a result, a large series from eight States has been brought together. Acknowledgments are due to Dr. Leonhard Stejneger, United States National Museum, for the loan of a series of *E. carolinense* from Florida, Georgia and North Carolina and for notes on Texas specimens of the genus; to Miss Mary Dickerson, American Museum of Natural History, for the loan of two examples of *E. texense* from Brownsville, Texas; to Mr. Julius Hurter of St. Louis, Mo., for examples of *E. carolinense* from Alabama, Louisiana, Missouri and Paris, Texas; and to Hon.

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* The Frog Book, New York, p. 168.

J. D. Mitchell of Victoria, Texas, for a series of *E. texense* and the type specimens of a new species herein described as *Engystoma areolata.*

In addition to these specimens, the writer has had access to the material in the herpetological collection of Baylor University, consisting of examples of *E. carolinense* from Arkansas and Missouri and of *E. texense* from several Texan localities. After a critical study of the material from all of the sources above mentioned, he has reached the following conclusions:

First. That the narrow-mouthed toad usually reported from Texas is not *Engystoma carolinense* but *E. texense* which is a very distinct species.

Second. That the *Engystoma carolinense* of Holbrook is exceedingly rare in Texas. The only typical specimen examined was from Paris, Lamar County, in the extreme northeastern section of the State.

Third. That a small form with unusually pustulate upper surfaces, peculiar coloration and short hind feet, from southeastern Texas, is worthy of recognition as a distinct species (*Engystoma areolata* Strecker).

Curiously enough, Dr. Stejneger had already noticed the peculiar character of some specimens from Victoria and Calhoun Counties, Texas, and in writing to me, gave me the benefit of his data. In southeastern Texas the new species occurs in localities inhabited by the widely distributed *Engystoma texense*, but in central Texas where the latter species is the prevailing or, as I am now fully satisfied, the only form of narrow-mouthed toad, no examples have been found that are even an approach to *E. areolata.*

Engystoma carolinense Holbrook.

This is the largest of the three forms here considered and the most widely distributed. Examples have been examined from Raleigh, North Carolina; Columbus, Georgia; Milton and Little Sarasota Bay, Florida; Mobile, Alabama; St. Tammany County, Louisiana; Hot Springs, Arkansas; Cliff Cave and Butler County, Missouri; and Paris, Texas. It has also been reported from Johnston and Wayne Counties, North Carolina;† Riceborough, Georgia; Clarcona, Laké Jessup and Micanopy, Florida; Greenway, Arkansas; Calcasieu Parish, Louisiana; New Madrid, Missouri, and various localities in Texas; but most of the Texan localities are open to doubt, this species probably being confused with *E. texense.*

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† C. S. Brimley, Journal Elisha Mitchell Sci. Soc., Dec. 1907, p. 159.

Some of the larger (female) specimens of this species attain a total length of 38 mm. The average length of twenty adults (10 males and 10 females) is about 30 mm. The body is stout, the greatest width of a finely preserved example 37 mm. in length being 21 mm. The upper surfaces are black, brown or dark gray. The markings are usually in the form of two oblique bands (black or brown) one on each side, extending from the eyes to the posterior part of the body. Under surfaces gray or light brown, speckled with white or light yellow. The head is pointed, but not so conspicuously as in the slender-bodied *texense*. Canthus rostralis not prominent. The limbs are longer and heavier than those of the other two species. The skin is either entirely smooth or very slightly pustular on the posterior portion of the body. The inner sole tubercle is larger than in examples of *texense* of approximately the same size.

The single example from Paris, Texas (No. 271, Hurter Coll.), is one of the largest examined and one of the most typical. The under surfaces are darker than usual and the blotches are unusually distinct. The inner sole tubercle is larger than in examples of the same size from Florida, Missouri, and Alabama.

An example from Cliff Cave, St. Louis County, Missouri (No. 111, Hurter Coll.), is the lightest colored specimen in the series but the markings are of the same type as in more eastern examples (North Carolina and Georgia). Three large specimens from Butler County, Missouri (Baylor University Collection), present a rather peculiar color pattern. The usual oblique bands are present but the dorsal area is heavily mottled with darker shades.

Examples from Mobile, Alabama (No. 2763, Hurter Coll.), and St. Tammany County, Louisiana (No. 957, Hurter Coll.), are unusually dark. The Louisiana specimen, while less than half grown, has the inner sole tubercle well developed.

In two specimens from Raleigh, North Carolina (U. S. National Museum Collection), the color pattern is unusually distinct. Nearly all of the specimens from Florida and Georgia are old and the color pattern is almost entirely obliterated from long immersion in spirits.

As a whole, the series presents very little variation excepting in color. The majority of the specimens are large and smooth-skinned, with the color of the under surfaces very distinct. The specimens from North Carolina are the most pustular but the minute pustules are confined to the sides and posterior extremities. The Missouri, Alabama and Texas specimens are the smoothest-skinned examples in the series. The inner sole tubercle is better developed in the more western examples.

Engystoma texense Girard.

This is the prevailing form of *Engystoma* in central and southern Texas. I have examined authentic specimens from Brownsville (Am. Mus. Nat. Hist. Coll.), Victoria, Refugio, Waco, Laguna and Calvert. The examples from most of these localities were formerly referred by me to *E. carolinense*, but at the time I had only a few half-grown specimens of that species from Hot Springs, Arkansas, for comparison. *E. texense* is also recorded from Rio Seco (type locality) and San Diego (Dickerson).

Cope recorded *E. carolinense* from Dallas, Houston and San Antonio, but these records were doubtless based on specimens of the species now under consideration. Miss Dickerson mentions the same species from Hitchcock, and, unless the specimen referred to belongs to the new species, *E. areolata*, the record carries the range of the eastern species much further south in the coast region of Texas than the localities represented in the present lot of material would indicate.

Description.—Size small, total length from 22 to 29 mm. Greatest width of body usually less than half the length from muzzle to vent. Color in alcohol (specimens comparatively fresh) gray, greenish or light brown. Markings consist of a few scattered spots. Under surfaces, white. In a very few examples, the throat is slightly spotted with a shade of gray.

The skin of the underside of the body is very thin, the outlines of the internal organs showing through. The body is slender, skin of upper surfaces very smooth. Muzzle pointed. Canthus rostralis unusually prominent. Inner sole tubercle small. Hind limbs short.

It differs from *E. carolinense* in smaller size, lighter colors, entirely different color pattern, unspotted underparts, slender body, more uniformly smooth skin and much shorter limbs.

Several examples from Laguna and Waco, Texas (Baylor University Collection), at a first glance appear rough-skinned, but this is a defect in the preservation and is caused by a general shrinkage of the skin. These specimens are darker than usual, but they otherwise agree with Brownsville examples in all important characters. In the general color of the upper surface, specimens of *E. texense* vary considerably, but in only a very small per cent of the material examined do the markings show any indications of forming any definite pattern. The spots are small and usually very widely scattered. In the majority of cases there are more spots on one side than on the other. Unmarked examples are not rare. In a very few examples, the markings of the hind limbs show an approach to the formation of regular bands as in *E. carolinense*. The specimen figured in Miss Dickerson's "Frog Book" (Plate LX. Fig. 5) has heavier markings than any specimen now in my possession. Another Brownsville example has less than a dozen small scattered black spots.

Engystoma areolata sp. nov.

Type No. 501, Collection of J. D. Mitchell, Victoria, Texas, from Guadalupe River bottom, Victoria County, Texas, January, 1909. Cotype in Baylor University Museum (No. 4086).

Description.—Size small (about equal to *E. texense* Girard). Total length of type, 22 mm. Body stout, more uniform in width than *E. carolinense.* Color (in alcohol) above, light gray, with darker markings which are heaviest in the dorsal region. Style of markings might be termed "marbling" on account of their irregular outlines and light colored interspaces. Limbs heavily marked. Under surfaces, light gray with closely placed lightish spots. Skin of back areolated, even pustular on the posterior part. Pustules very uniformly distributed. Muzzle shorter than in examples of *E. carolinense* and *E. texense* of the same size. Canthus rostralis not prominent. Hind limbs short. Hind foot unusually short. Inner sole tubercle large.

Compared with *E. carolinense* it differs in its smaller size, in the generally more regular outline of the body as viewed from above, in the shortness of the hind leg and foot and in the remarkably pustular appearance of the upper surface of the body. The inner sole tubercle is much larger than in examples of *E. carolinense* of the same size.

It resembles *E. texense* in size and in the shortness of the hind limbs but in no other characteristic.

Two specimens of *Engystoma areolata* collected with the type (No. 501*a*, Mitchell Collection, and No. 4086, Baylor University Collection) are similar in every respect excepting in color. One of these specimens has much the same color pattern but the markings are heavier and the ground color lighter. The other is rather dark and the back and upper surfaces of the limbs are marked with closely placed blotches of brownish olive. In the type a dark line extends along the muzzle from orbit to orbit and there is a small dark broad V-shaped mark between the orbits. No dark line along the sides as in *carolinense*. The data accompanying these specimens is as follows:

"Found under logs associated with examples of *Engystoma texense*, *Bufo valliceps*, *Hyla cinerea*, *Hyla squirella*, *Rana pipiens*, *Anolis carolinensis*, *Eumeces quinquelineatus*, *Leiolepisma laterale*, *Ancistrodon contortrix*, numerous species of beetles, ants and other insects." (J. D. Mitchell.)

Dr. Stejneger has given me the following notes on Texas specimens examined by him some years ago. These notes doubtless refer to *E. areolata*:

"No. 35,942 (U. S. Nat. Mus. Coll.) Victoria, Texas, J. D. Mitchell, collected in 1897. Skin of back areolated.

"Four specimens (Victoria High School Collection, No. 52), collected by Mitchell under timber in Spring Marsh, Well Camp, Alligator Head, Calhoun County, Texas, March, 1902, also have the back areolated, the posterior part even pustular. Metatarsal tubercle rather large and hind feet short."

NOTES ON THE HABITS OF THE NARROW-MOUTHED TOADS.

On account of their strictly nocturnal habits, very little is known of the life histories of these diminutive toads, but the following data may shed some light on their habitat relations:

Engystoma carolinense.—Dr. E. Loennberg[*] states that in Florida he "found this peculiar little animal under old logs, dry palm leaves and such things near lakes and in moist places in Orange County, for instance, in the pineland at Clarcona and the hummocks bordering Lake Jessup." Mr. C. S. Brimley says that at Raleigh, N. C., the narrow-mouthed toad breeds from May to August. "I can get them from May on in warm, damp weather." This species is confined principally to the humid division of the Lower Austral Life Zone. The other two species are inhabitants of the dryer portions of the same zone although the range of *texense* extends into the humid division.

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[*] Proc. U. S. National Museum, 1894, Vol. 17, page 338.

Engystoma texense.—The following interesting extract is from a letter from J. D. Mitchell dated March 8, 1909:

"Here is a sight I witnessed on the 20th of February, in the Guadalupe River bottom, Victoria County: Under a log, in a depression 12 x 16 inches and 3 inches deep were two *Ancistrodon contortrix* (adults), one *Rana pipiens*, one *Hyla squirella*, one *Hyla cinerea*, two *Engystoma*, three *Bufo valliceps*, two *Eumeces quinquelineatus*, one *Leiolepisma laterale* and between 500 and 1,000 crickets about one-third grown. One toad was within the folds of one of the snakes and none of the toads, frogs or lizards were over eight inches from the snakes and the crickets covered the whole business. Verily, cold weather, like politics, makes strange bed-fellows. The crickets hopped and scattered, but all of the others remained quiet in their winter forms until handled. The stomachs of the moccasins were perfectly empty."

In December, 1903, at Laguna, Falls County, the writer found a number of examples of *Engystoma texense* under logs lying along the edge of a lagoon, in button-willow thickets. Under these logs were also specimens of *Rana pipiens*, *Hyla cinerea*, and *Ambystoma microstomum*. In a strip of oak woods on the east side of the Brazos River, not far from Waco, narrow-mouthed toads are rather common during the fall and spring months. They are usually found under logs and dead stumps that are deeply imbedded in the ground. From two to four examples are usually found in the same place.

On May 20, 1897, I found great numbers breeding in company with *Chorophilus triseriatus* Wied and *Bufo debilis* Girard, in water-filled sinks on the mesquite prairie about two miles west of the city of Waco. During the spring rains the water-filled ditches along the railroad tracks in East Waco are much frequented by these toads. Here, at night, their sharp, buzzing notes are interspersed with the louder cries of *Scaphiopus couchii* and *Bufo debilis*, forming a rather unmusical chorus.

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PROCEEDINGS
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NOTES ON THE SCALES OF FISHES. THE HERBIVOROUS CYPRINIDÆ.

BY T. D. A. COCKERELL AND OTIS CALLAWAY.

It has been remarked by Jordan and Evermann (Fishes of North and Middle America, p. 202) that the subfamily *Chondrostominæ*, as recognized in America, is extremely heterogeneous. A study of the scales of most of the genera clearly indicates that the group is even less uniform than has been supposed, and makes it practically certain that it should be divided into three subfamilies, which are not especially related. *Chrosomus* stands entirely apart in the structure of its scales, which resemble in sculpture those of Catostomidæ. The Catostomids are evidently an ancient, and in some respects, primitive group, which probably inhabited North America before there were any true Cyprinidæ on this continent. *Chrosomus* may not be supposed to have been derived from the Catostomids, but must apparently be regarded as an ancient offshoot from the stem which gave rise to Cyprinidæ and Catostomidæ alike.

Contrasting with *Chrosomus* in nearly every way, but related to it in the small scales and the traces of basal radii, is the Chondrostomine group proper, including fishes of the Pacific coast region, closely related to those of the Old World.* These must be regarded as comparatively recent (Miocene?) immigrants, which have never crossed the Rocky Mountains. The third series typified by *Pimephales*, consists of large-scaled fishes with no traces of basal radii. They are entirely different from the two small-scaled groups, and must have had a quite distinct origin. In their scaling, however, they show a distinct approximation to the otherwise aberrant *Campostominæ*, and it is probably safe to say that they are much nearer *Campostoma* than are any of the other herbivorous genera.

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* Basal radii are common in Old World Cyprinidæ, but exist in very few North America genera. *Rhinichthys* and *Agosia* have them, but they are absent in the great mass of the carnivorous forms.

Depending principally on scale characters, the four subfamilies of herbivorous Cyprinids may be separated as follows:

SUBFAMILIES OF NORTH AMERICA HERBIVOROUS CYPRINIDÆ.

Scales small, with small radii all around; breadth usually greater than length, the scales transversely suboval. Small fishes of the Eastern United States, with two dark bands on each side, the upper sometimes faint.
CHROSOMINÆ (*Chrosomus* Raf.).

Scales small, with strong but not very numerous apical radii, basal radii evanescent but usually more or less indicated. Silvery fishes of the Pacific coast region without evident dark band.
CHRONDROSTOMINÆ (*Acrocheilus* Agass., *Orthodon* Girard).

Scales large and broad, apical radii numerous, no trace of basal radii.
Nuclear area large and very broad, the radii subparallel.
CAMPOSTOMINÆ (*Campostoma* Agass.).[*]
Nuclear area small, the radii converging; fishes of small or moderate size with one dark lateral band.
PIMEPHALINÆ (*Pimephales* Raf., *Hybognathus* Agass.).

Hybognathus is remarkable for the very thick skin covering the scales; in *Pimephales* the skin is thin, and the radii are clearly visible. The gill-lamellæ, judging from our material, appear to present diagnostic characters. In *Orthodon* and *Acrocheilus* they are disposed in a very regular manner, fitting closely together. In *Hybognathus nuchalis* they are regular, and scarcely fimbriate, but in *Pimephales anuli* they are strongly fimbriate. In *P. anuli* they are obtuse apically; in *P. notatus* tapering. In *Chrosomus dakotensis* they are stout, in *C. erythrogaster* slender. Possibly these characters would not hold good in a long series of the fishes. In any event, they seem to be of specific rather than generic or subfamily importance. The fishes upon which this study is based were with two exceptions kindly sent to us by the U. S. Bureau of Fisheries and Stanford University. For the Old World (River Nile) species we are indebted to the Government of Egypt, through the British Museum. We are indebted to Doctors David Starr Jordan and Barton Warren Evermann for very kindly going over our manuscript.

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[*] The pharyngeal teeth of *Campostoma* are more or less hooked and really very like those of *Leuciscus*, etc. The relationship of the Campostominæ and Pimephalinæ to the Leuciscine series is a matter to be further investigated.

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PROCEEDINGS
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GENERIC NAMES OF SOME CHELYID TURTLES.

BY LEONHARD STEJNEGER.

The generic name *Hydraspis* Bell is currently applied to a group of South American Chelyid turtles which has Schweigger's *Emys geoffroana* as type. This practice is quite erroneous, however.

The name was instituted by Thomas Bell in 1828 (Journ. Zool., vol. 3, p. 512). In doing so he said: "I had long ago believed that *Testudo longicollis* might prove to be the type of a genus, and subsequent observations upon several other species has convinced me that the conjecture was correct," and further down, in enumerating the species which he includes in this genus he begins with "*Testudo longicollis*, which I consider the type." This is consequently a case to which Art. 30, sec. *a* of the International Rules of Zoological Nomenclature applies directly, viz: "When in the original publication of a genus, one of the species is definitely designated as type, this species shall be accepted as type regardless of any other considerations. (Type by original designation.)"

It is of no consequence that Bell in another paper printed immediately after the one alluded to above, under the genus *Hydraspis* designates another species as type as follows: "Sp. typ. *H. galeata* (*Testudo galeata*. Auct.)" (Journ. Zool. vol. 3, 1828, p. 515), especially since this action of his has nothing to do with the subsequent one of Gray in diverting *Hydraspis* to the group represented by *E. geoffroana*.

But by designating *T. longicollis* as the type of *Hydraspis*, Bell overlooked the fact that Fitzinger two years previously had designated the same species as type of *Chelodina*. In his Neue Classification der Reptilien, 1826, p. 6, Fitzinger says that "Oppel indicated the separation of *Emys longicollis* and its consorts which I include in my genus *Chelodina*." *Hydraspis*, therefore, is only a synonym of *Chelodina* and must disappear as a valid generic term.

The question now arises as to the proper name for the genus currently known by this term.

In 1830 Wagner (Syst. Amph., p. 134) established the genus *Rhinemys* for four species, viz.: *Emys rufipes* Spix; *E. nasuta* Schweigger; *E. radiolata* Mikan; and *E. gibba* Schweigger, without designating any type. This was done in 1843 by Fitzinger (Syst. Rept., p. 29) who specifically designated *Rhinemys rufipes* Wagler as the type. Wagler in the same publication, but on a subsequent page (Syst. Amph., 1830, p. 135), established the monotypic genus *Phrynops* for *Emys geoffroana*. These two species have since proved to be congeneric, and one of the generic terms applied to them must serve for the combined genus. Here Art. 28 of the International Rules of Zoological Nomenclature provides as follows: "A genus formed by the union of two or more genera or subgenera takes the oldest valid generic or subgeneric name of its components. If the names are of the same date, that selected by the first reviser shall stand." The first reviser in this case was J. E. Gray (Cat. Tortois., Brit. Mus., 1844, p. 41), who included both *E. geoffroana* and *E. rufipes* in the same genus, for which he selected *Phrynops* as the name, at the same time distinctly giving "*Phrynops* and *Rhinemys* Wagler" as synonyms. This action consequently "shall stand," to use the phrase of the International Rules.

By this combined action of Fitzinger and Gray the genus represented by Schweigger's *Emys nasuta* is deprived of a valid name. Boulenger (Cat. Chel. Brit. Mus., 1889, p. 217) applied to it Wagler's name *Rhinemys*, but as we have seen, the type of the latter, as designated by Fitzinger, is *E. rufipes*. There being no other name available I propose to call this genus **Batrachemys** (from βατράχος, frog; εμυς, turtle).

The synonymies of these genera, as here mentioned, would then stand as follows:

Chelodina Fitzinger.

1826. *Chelodina* Fitzinger, Neue Classif. Rept., p. 6 (type, by orig. desig. *Emys longicollis*).

1828. *Hydraspis* Bell, Zool. Journ., vol. 3, p. 512 (type, by orig. desig. *Testudo longicollis*).

Includes the following species:

1. *Chelodina longicollis* (Shaw).
2. *Chelodina novae-guineæ* Boulenger.
3. *Chelodina expansa* Gray.
4. *Chelodina siebenrocki* Werner.
5. *Chelodina oblonga* Gray.

Phrynops Wagler.

1830. *Rhinemys* Wagler, Syst. Amph., p. 134 (type, by subsequent desig. by Fitzinger in 1843, *R. rufipes*).

1830. *Phrynops* Wagler, Syst. Amph., p. 135 (monotype, *Emys geoffroana* Schweigger).

Includes the following species:

1. *Phrynops geoffroana* (Schweigger).
2. *Phrynops hilarii* (Duméril and Bibron).
3. *Phrynops tuberosa* (Peters).
4. *Phrynops rufipes* (Spix).
5. *Phrynops wagleri* (Duméril and Bibron).

Batrachemys Stejneger.

1889. *Rhinemys* Boulenger, Cat. Chel. Brit. Mus., p. 217 (monotype, *Emys nasuta*, Schweigger) (not of Wagler as restricted by Fitzinger, 1843).

Includes:

1. *Batrachemys nasuta* (Schweigger).

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PROCEEDINGS
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SOME NOTES ON THE ZOOLOGY OF LAKE ELLIS, CRAVEN COUNTY, NORTH CAROLINA, WITH SPECIAL REFERENCE TO HERPETOLOGY.

BY C. S. BRIMLEY.

The writer in company with some of his friends spent about a week in the vicinity of Lake Ellis, Craven County, N. C., in late June, 1905, about two weeks in early May, 1906, and nearly a week each, in late May of 1907 and 1908. On all of these occasions he made observations on and collected specimens of the reptiles and batrachians he came across.

Mr. H. H. Brimley, Curator of the North Carolina State Museum at Raleigh, headed the party in 1905, 1906, and 1908, but was absent in 1907, in which year the party was headed by Mr. Franklin Sherman, Entomologist to the North Carolina Department of Agriculture, who was also one of the party in 1905 and 1908. Mr. R. S. Woglum, at that time acting entomologist in Mr. Sherman's place, was one of the party in 1906.

During our stays there we lived in Camp Bryan, a three-room hunting camp, the use of which together with other privileges was generously granted by Mr. G. A. Nicoll of Newberne.

Lake Ellis is a shallow body of water in Craven County, situated some five or six miles west of Havelock, a station on the Norfolk and Southern railroad. It is between one and two miles in width and breadth, its limits being somewhat indefinite owing to its shallowness and the amount of surrounding marsh which may or may not be actually included in the lake, at different heights of water. Running east and west through the lake is the "north canal," the banks of which are wholly submerged for at least half the distance, and which in its lower portion receives the water of the lake from a ditch entering obliquely on the south side. The canal empties into Slocum's Creek, which in turn runs into Neuse River some distance below Havelock. A second canal or ditch, the "south canal," runs out of the lake about a mile south of the north canal and parallel to it; but it contains running water only when the lake is comparatively high. Lake Ellis is quite shallow, its depth not exceeding two feet at the times when I was there, and on the submerged bank of the canal, which was our usual route to Great Lake, was only from a few inches to a foot deep except in alligator holes.

Great Lake, a much larger and deeper body of water, lies due west from Lake Ellis, into which it drains, and is separated from Ellis by a tract of woods, about half a mile wide. Little Lake, similar in character to Great Lake, lies about as far from Ellis on the north, and is likewise bordered on the Ellis side by woods. Long Lake and Catfish Lake, the other two lakes of the group, I did not visit.

Of mammals, some cotton mice (*Peromyscus gossypinus*) were taken in the camp in May, 1906, a cotton rat (*Sigmodon hispidus*), was killed outside camp in May, 1908, while roof rats were seen dead by my brother when on a visit there in the winter of 1908–9. Marsh rabbits (*Lepus palustris*) are plentiful in the vicinity, while the Virginia deer, wild cat, opossum, raccoon and bear also occur in greater or less numbers. There were no signs of muskrats around the lakes, nor has my brother ever noticed any during any of his hunting trips there in the winter.

Among the fishes, mud minnows (*Umbra pygmaea*) were not uncommon in the pools where the *Stercochilus* were taken, ditch fishes (*Chologaster cornutus*) were abundant both in the lake and in the pools of water above mentioned, while swamp darters (*Copelandella quiescens*) were also fairly common in the lake. No other fishes of especial interest were noted.

A small shrimp (*Palæmonetes*) was quite common in the lake, as also were crayfish (*Cambarus blandingi*).

A small red creature apparently a mite of aquatic habits was common in the waters of the lake, and was said to sting like "stinging nettles" (Jellyfish), but we were none of us harmed by it.

Quite a large number of species of reptiles and batrachians were observed, these being mainly Lower Austral forms, and I here give a full list of them, adding also some unpublished records from other portions of eastern North Carolina.

Plethodon glutinosus.

VISCID SALAMANDER.

Found rather commonly under logs in woods in all four years.

Stereochilus marginatus.

MARGINED SALAMANDER.

A single specimen taken under a log in Great Lake woods in June, 1905, and not noted to be other than *Desmognathus fusca* till after my return to Raleigh, first called our attention to the fact that this rare species occurred in this region. Special attention was devoted to securing it in 1906, our efforts meeting with great success. One day Henry, our colored cook, led us to look for an alligator which he had seen in the south canal. On arriving at the canal my hopes began to rise as it was nearly dry, there being no stream running through it, and only a few small pools of water standing in its bed, below where the waters of the lake ceased. These pools looked just the right kind of place for the larvæ of *Spelerpes ruber* and hence by analogy for *Stereochilus* which so greatly resembles them in form. My brother and I set to work to drag out the dead leaves and vegetable mud, and throw it up on the sloping banks of the canal. On doing this the sirens or salamanders would crawl from under the trash and run swiftly towards the water, in doing which they were usually captured after a second or two of exciting suspense. In this way we soon began to get *Stereochilus* and before we ceased operations had nearly a dozen, some being obtained by merely scraping away the covering of semi-decayed vegetable matter around the edges of the pools. In the afternoon my brother kept up the good work and got more specimens.

Two days later, finding that the pools had been about worked out, I went down the bed of the canal and scraped away with my hands the layers of vegetable debris whenever I came to a likely place, and secured in this way something over twenty specimens. They were mostly found lying in little cells just below the surface layer of vegetable matter. One siren, three small *Farancia*, one small *Abastor*, and three *Rana virgatipes* were also captured at this time.

A few days later I was in Great Lake woods and devoted my energies to dipping out the pools at the lower end of the old overflow from Great Lake into Lake Ellis, with the result of getting about twenty *Stereochilus* (about half of them larvæ), half a dozen small sirens, and two small amphiumas.

In 1907 and 1908 the water in Ellis was somewhat higher. Only seven specimens were secured in 1907 (five of them by dipping while the other two were dug up out of the marsh by Sherman while looking for fish-bait), and only about four or five in 1908.

In habits *Stereochilus* seems to approach *Siren* and *Amphiuma* with which it was found associated, being apparently an aquatic mud-burrower.

In general form the animal very much resembles a larval *Spelerpes* but differs from them in its markings. The general larval appearance however, together with the absence of gills is sufficient to easily distinguish it from all our other salamanders.

In color it is brown with longitudinal dark lines along the sides, these being often more or less broken; the underparts are pale usually sprinkled with little dark spots like fly-specks, but they are occasionally marbled or immaculate. The larvæ, which attain nearly the size of the adult before losing the gills, are similar in color, but usually unspotted below and with the lines on the sides less pronounced; occasionally, however, they differ from the adults only in the presence of gills. One adult had the gills lacking but the gill cleft still open. The groups of large pores on the head are very characteristic, and even to the naked eye give it a pitted appearance.

The measurements of fourteen adults, including all the largest, were: Total length, maximum 95, minimum 65, average 81; tail, maximum 45, minimum 31, average 36.7. Eleven larvæ measured as follows: Total length, maximum 87, minimum 62, average 75.5; tail, maximum 42, minimum 29, average 36.7.

Desmognathus fusca.

BROWN TRITON.

Common, usually under trash or dead leaves near water, less aquatic than *Stereochilus*.

Amphiuma means.

DITCH EEL.

Two specimens 201, and 195 mm. long taken in pools in Great Lake woods in May, 1906. These were of course typical *means*, with two-toed feet, and darker and more uniform coloration. Of the two forms of the ditch eel I have had numbers of specimens and have never seen any intergrades. The three-toed specimens (*tridactyla*), of which I have had over a hundred at different times, all from Hale County, Alabama, differed from the two-toed ones in being lighter colored both above and below, and in living specimens at least, in being distinctly bicolored, the underparts being nearly white and distinctly defined from the color of the sides, and not gradually fading into it; the limbs of the three-toed form also seem to me to be more strongly developed than in typical *means*. Typical *means* is distinguished from *tridactyla*, by the smaller number of toes and by the color being blackish above, passing gradually into paler slate below. It does not seem to attain as great a size as *tridactyla*, as although I have handled as many specimens as of the other, I have never seen a *means* attain the size and particularly the girth of the largest specimens of *tridactyla*, I had one recently that measured 29 inches long and 6 inches in girth, and I think I have seen still bigger ones.

Siren lacertina.

BLACK EEL.

Thirteen specimens ranging from 120 to 222 mm. long taken in pools in May, 1906, as described under the head of *Stereochilus*.

Hyla squirella.

SQUIRREL TREEFROG.

A number were sent me by Mr. J. J. Ballard in June, 1906. Has also been taken at Cape Hatteras by H. H. Brimley in July, 1905, and by Franklin Sherman near Southport in October, 1906.

Hyla femoralis.*

PINE TREEFROG.

Three taken on trees along the edge of the north canal in May, 1907. (Also taken by Sherman near Wilmington in December, 1901.)

Acris gryllus.

CRICKET FROG.

Abundant.

Bufo americanus.

COMMON TOAD.

Three adults taken in May, 1907, were typical *americanus*, and not *lentiginosus*.

Bufo quercicus.

DWARF TOAD.

About half a dozen taken in dryer situations in May, 1906. (Also taken by Sherman on Shackleford's Banks, near Beaufort, N. C., in June, 1901.)

Rana pipiens.

LEOPARD FROG.

The commonest and most evenly distributed *Rana* of the region.

Rana clamata.

SPRING FROG.

A single small specimen taken in a pool in Great Lake woods in May, 1907.

Rana catesbiana.

BULLFROG.

Heard on each trip. A few were seen, but none taken.

Rana virgatipes.

COPE'S FROG.

Six specimens taken in 1906 and 38 in 1907, none being over 45 mm. in length of head and body. These little frogs were found in shady places wherever there was water, and in such situations acted much like cricket frogs, almost always coming to the surface immediately after jumping into the water, and seldom diving to the bottom and hiding there.

Anolis carolinensis.

GREEN LIZARD.

A few seen each year.

Eumeces fasciatus.

BLUE-TAILED LIZARD.

A few each year.

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*A third of the southeastern treefrogs, *Hyla cinerea*, the Carolina treefrog, was taken by H. H. Brimley at Cape Hatteras in July, 1905.

Liolepisma laterale.

GROUND LIZARD.

Occasional.

Carphophiops amoenus.

GROUND SNAKE.

Taken each year rather commonly under logs in woods.

Farancia abacura.

RED-BELLIED HORN SNAKE.

Three small specimens and three good-sized adults taken in May, 1906. The latter were taken by H. H. Brimley and were *in coitu*, the third specimen, an albinistic male with the red of the lower parts replaced by pure white, being twined up with the other two, a normal male and female. The female, the largest of the three, measured 1,417 mm. long (a specimen taken by H. H. Brimley, near Newberne in 1885, measured 1,847 mm. long and is the largest specimen of which we have heard).

Abastor erythrogramus.

HOOP SNAKE.

A small specimen and an adult taken in 1906. In spite of the vernacular name given, all the evidence seems to point to *Ophisaurus ventralis* (the joint snake), being the hoop snake of vulgar fable. When this latter animal has had its tail broken off at all near its body and has started to grow a new one, the new portion is of quite a different color from the rest of the tail and looks not unlike a short stout horn, and this fact is, I believe, the basis for all the wonderful yarns about the hoop and horn snakes.

Diadophis punctatus.

RING-NECKED SNAKE.

One taken in May, 1906, and another in 1907, both while looking for *Stereochilus* in Great Lake woods. Both specimens had the yellow neck ring incomplete above, it being interrupted in the center by a narow bar of the color of the back.

Ophibolus getulus.

KING SNAKE.

Rather common.

Bascanium constrictor.

BLACK SNAKE.

Common.

Coluber guttatus.

RAT SNAKE.

One killed by Woglum in May, 1906.

Coluber quadrivittatus.

STRIPED CHICKEN SNAKE.

One taken by Sherman and myself in May, 1908. It was a good-sized adult, quite dark in coloration. (Also taken by H. H. Brimley at Cape Hatteras in July, 1905.)

Heterodon simus.

HOG-NOSED SNAKE.

One brought us by Mr. Ballard in June, 1905. (Two specimens taken in Wake County, near Raleigh in October, 1907.) The spreading adder (*Heterodon platyrhinus*), so common in the interior of the State, was not observed in either year.

Haldea striatula.

BROWN SNAKE.

One specimen brought us by Mr. Ballard in June, 1905. Very young specimens of this species not infrequently have a white crossband or half collar on the nape.

Natrix fasciata.

SOUTHERN WATER SNAKE.

Two medium-sized specimens taken, one in 1906, the other in 1907, belong to this form. No specimens of *N. sipedon* were taken.

Natrix fasciata erythrogaster.

COPPERBELLY.

One a little over 1,200 mm. taken in May, 1906, and two, one 1,200, the other 1,100 mm., in May, 1907. These Copperbellies, as they are called in North Carolina, are uniform rusty red above, and yellowish red below. This form also occurs at Raleigh, where *sipedon* and not *fasciata* is the prevailing form.

Natrix taxispilota.[*]

PIED WATER SNAKE.

This snake seemed to be not uncommon in the region, though but three specimens were actually secured, one in each year. The 1907 specimen was the longest, measuring 1,340 mm. in length. Tails of two specimens were taken from the stomachs of alligators in 1906, a part of one was vomited by a young cormorant in 1905, and one or two specimens were seen alive but not secured.

Ancistrodon piscivorus.

COTTON MOUTH.

Two good-sized specimens killed in June, 1905; not seen in other years.

Ancistrodon contortrix

COPPERHEAD.

One specimen of this snake was killed by Woglum in Little Lake woods in May, 1906.

Crotalus adamanteus.

DIAMOND RATTLESNAKE.

A large skin of this species is in the State Museum at Raleigh, and was sent there from Havelock, near which place it was killed.

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[*] A specimen of *Tantilla coronata*, our only eastern Dipsadine snake, was brought to me at Raleigh May 6, 1905, by a colored boy who said he had found it on the edge of some woods. Taken at Southern Pines, by G. M. Gray, May, 1909.

Crotalus horridus.

BANDED RATTLESNAKE.

Said to be not uncommon, and H. H. Brimley killed one near camp in May, 1908. Henry knew both the diamond and banded rattlers, but seemed to think they were merely different sexes.

Terrapene carolina.

BOX TORTOISE.

A single specimen of the highland terrapin, as it is called in the South, was seen in June, 1905.

Pseudemys scripta.

LADY TERRAPIN.

Common; specimens seen and taken in all three years, the largest weighing 8½ pounds. In 1905 many broken eggs were seen along the banks of the canal, the contents of which had been probably consumed by the raccoons that had dug them up. On May 24, 1907, on our way to camp from Havelock, I found a good-sized specimen which had been digging a hole to lay its eggs in. The hole had evidently been dug by the hind feet, as these were covered with dirt, while the fore feet were completely clean. The hole was some three or four inches deep, and just large enough to admit the animal's hind foot.

Pseudemys floridana.

FLORIDA TERRAPIN.

A shell of this species seen in 1905, and another in 1906.*

Aromochelys odoratus.

MUSK TURTLE.

One taken each year in 1905, 1907 and 1908.

Chelydra serpentina.

SNAPPING TURTLE.

Not seen, but is known to occur in Slocum's Creek.

Alligator mississippiensis.

ALLIGATOR.

Alligators were apparently common in all the lakes, but none were abroad in open water in 1906 or 1907, it being too early in the season. In 1905 a nine-foot specimen was killed by H. H. Brimley, on Great Lake, on the first day of our stay, and a number of others were seen on Great, Little, and Ellis Lakes. In May, 1906, eight specimens ranging from 5 feet 3 inches to 7 feet 11 inches were dug out of their holes and shot. In 1907 none were observed. The method adopted to secure them in 1906 was briefly as follows: The party looking for them searched around the edge of the marsh or of an island until a place was found where it was evident from the muddy water that an alligator had gone into his hole. One man with a fish gig thereupon probed about through the surface layer of roots and grass until he found the alligator's body, when he stuck in the gig and held on. A second man with a spade then dug a hole through the marsh as near as was convenient, making sure, of course, of digging into the alligator's run. A pole was then procured and the animal prodded with it until he not only bit but held on. He was then dragged to the surface until sufficient of his head was visible to allow the man with the rifle to finish him with a bullet through the brain.

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* Three good-sized adults of this species were brought me from the vicinity of Richardson's Pond on Buffalo Creek, in Johnston County, N. C., on June 28 and 30, 1905, by Frank Lewis, who caught them while seining.

Henry informed me that a small flat terrapin with round yellow spots, which was, of course, *Chelopus guttatus*, occurred in the streams of that region.

None were taken or looked for in 1907, and only one captured in 1908, no special effort being made in either year to procure specimens.

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PROCEEDINGS

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FIVE NEW WOODRATS OF THE GENUS *NEOTOMA* FROM MEXICO.

BY E. A. GOLDMAN.

Recent study of the large series of woodrats in the Biological Survey Collection has resulted in the discovery of four undescribed subspecies—three members of the *Neotoma intermedia* group, and a high mountain form of *Neotoma ferruginea*. Through the kindness of Mr. Outram Bangs I am able to include also a description of a well-marked species collected for Mr. John E. Thayer, on the small island of San Francisco in the Gulf of California.

Neotoma intermedia pretiosa subsp. nov.

Type from Matancita (called also Soledad), 50 miles north of Magdalena Bay, Lower California, Mexico (altitude 100 feet). No. 146,123, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected November 17, 1905, by E. W. Nelson and E. A. Goldman. Original number 18,589.

General characters.—Size much larger and color paler than *N. intermedia*. Similar in size to *N. i. arenacea*, but color paler; tail shorter; audital bullæ larger.

Color.—Worn pelage: Upper parts very pale drab gray, purest along cheeks and sides, overlaid on top of head and back by dusky or rusty hairs; feet and underparts white; tail blackish above, grayish below.

Skull.—Similar in general to that of *N. intermedia*, but very much larger and more angular; supraorbital ridges more prominent. In size the skull is similar to that of *N. i. arenacea*, but dentition heavier; bullæ much larger.

Measurements.—Average of 6 adult topotypes: Total length, 374; tail vertebræ, 166; hind foot, 39.3. Skull: Basilar length, 39.4; zygomatic breadth, 24.6; length of nasals, 18.2; alveolar length of upper molar series, 9.3.

Neotoma intermedia perpallida subsp. nov.

Type from San Jose Island, off east coast of Lower California, Mexico.

No. 79,061, U. S. National Museum, Biological Survey Collection. ♂ young adult. Collected August 4, 1895, by J. E. McLellan. Original number 1449.

General characters.—Most nearly related to *N. i. vicina*, but color still paler and tail averaging slightly longer; skull about the same. Similar in color to *N. i. gilva*, but underparts purer white and tail not basally buffy; tail more scantily haired; skull differing in details.

Color.—Nearly fresh pelage: Upperparts drab gray, paler than in *vicina*, moderately darkened over back by black or brownish hairs; feet and underparts white; tail brownish above, grayish below.

Skull.—About like that of *N. i. vicina*, much as in *N. intermedia* and *N. i. gilva*, but somewhat larger; bullæ slightly smaller.

Measurements.—Average of 6 adults: Total length, 359; tail vertebræ, 172; hind foot, 35. Skull (average of 4 adults): Basilar length, 31; zygomatic breadth, 22; length of nasals, 16.8; alveolar length of upper molar series, 8.6.

Remarks.—The Biological Survey Collection contains 2 specimens of this form. Mr. Outram Bangs has kindly furnished for examination a fine series of additional specimens—11 skins and skulls collected on San Jose Island by Mr. W. W. Brown, Jr., in June, 1908, and February, 1909, for Mr. John E. Thayer.

Neotoma intermedia vicina subsp. nov.

Type from Espiritu Santo Island, off east coast of southern Lower California, Mexico. No. 146,803 U. S. National Museum, Biological Survey Collection. ♂ adult, collected February 9, 1906, by E. W. Nelson and E. A. Goldman. Original number 19,082.

General characters.—Most nearly related to *N. i. perpallida*, but color darker and tail averaging slightly shorter. Somewhat similar to *N. i. arenacea*, but smaller; color paler; audital bullæ relatively larger.

Color.—Fresh pelage: Upperparts dull grayish or brownish drab, lighter along cheeks and sides, moderately darkened over top of head and back by overlying dusky hairs; feet and underparts white; tail blackish above, grayish below.

Skull.—About as in *N. i. perpallida*. Differing from that of *N. i. arenacea* in smaller size, relatively heavier dentition, and relatively larger bullæ.

Measurements.—Average of 5 adult topotypes: Total length, 344; tail vertebræ, 162; hind foot, 34.5. Skull (average of 4 adults): Basilar length, 35.6; zygomatic breadth, 22.8; length of nasals, 16.4; alveolar length of upper molar series, 8.1.

Neotoma abbreviata sp. nov.

Type from San Francisco Island (near San Jose Island), off east coast of southern Lower California, Mexico. No. 12,260 Museum of Comparative Zoology. ♂ adult. Collected February 22, 1909, by W. W. Brown, Jr. (John E. Thayer Expedition).

General characters.—Size small; color very pale; tail decidedly shorter than head and body—shorter than in any other known member of the *intermedia* group. Somewhat like *N.* [illegible] very much paler, tail [illegible] in color to *N. i. perpallida* [illegible] very nearly related: [illegible] numerous details.

Color.—Fresh pelage: Upperparts [illegible] and sides, the dark hairs [illegible] enough to alter the general [illegible] part of back suffused with [illegible] white, the fur basally [illegible] white below.

Skull.—Somewhat like that of [illegible] lar; frontals narrower [illegible] shorter; more rounded; [illegible] (evenly convex in *intermedia*) [illegible] late or broadened at tip, [illegible] extension of supraoccipital [illegible] *abbreviata* is decidedly [illegible] teriorly, frontals relatively [illegible] middle; incisive foramina [illegible] bullæ shorter, more rounded.

Measurements.—Average of [illegible] vertebræ, 130; hind foot, [illegible] Basilar length, 34.1; zygomatic breadth, 21 [illegible] length of upper molar series, 8.4.

Neotoma ferruginea chamula* [illegible]

Type from mountains near San Cristobal, Chiapas, Mexico. Altitude 8,400 feet. No. 76,061, U. S. National Museum, Biological Survey Collection. ♂ adult. Collected [illegible] by E. W. Nelson and E. A. Goldman. Original number [illegible].

General characters.—Size [illegible] *N.* [illegible] but color much darker; fur [illegible] everywhere. Similar in size to *N. f.* [illegible] darker.

Color.—Type: Upperparts [illegible] palest along sides, rather heavily darkened by [illegible] hairs which are most abundant over back; outer sides of legs [illegible] the hind legs tinged with brownish buff; underparts dull white; nose, lips and ankles dusky; fore feet white; hind feet clouded with dusky to toes, the toes white, tail blackish above, grayish brown below.

Skull.—Closely resembling that of *N. ferruginea.* Similar to that of *N. f. isthmica*, but less massive and less arched across anterior roots of zygomata; nasals narrower posteriorly.

Measurements.—Type: Total length, 363; tail vertebræ, 178; hind foot, 39. Skull: Basilar length, 37.1; zygomatic breadth, 23; length of nasals, 18.3; alveolar length of upper molar series, 9.3.

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* From Chamula, the name of a tribe of Indians living at the type locality

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PROCEEDINGS

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BIOLOGICAL SOCIETY OF WASHINGTON

NEW RECENT INDIAN CRINOIDS.

BY AUSTIN HOBART CLARK.*

A second collection of recent crinoids received for study from the Indian Museum, consisting mostly of specimens taken in deep water, includes a rather large number of exceedingly interesting new forms, of which it appears advisable to publish preliminary diagnoses. Among the many important discoveries made by the *Investigator*, none is more gratifying than the finding of *Bathycrinus* in the Indian Ocean. Of the two forms obtained, one, the largest recent species belonging to the family Bourgueticrinidæ yet known, is related to a species previously dredged only in the far eastern tropical Pacific, while the other resembles most closely the remarkable form from the eastern Atlantic described by Professor Perrier as *Ilycrinus complanatus*, a species so peculiar that he was at first inclined to regard it as a possible monstrosity; these are both so similar to the aberrant *Apiocrinus recubariensis* of Crema (referred by Dr. Bather to *Millericrinus*) as to suggest that that species should best be referred to *Bathycrinus*.

The species diagnosed herein will be fully described and figured in one of the series of monographs published by the Indian Museum dealing with the fauna of the Indian Ocean.

FAMILY COMASTERIDÆ.

GENUS COMATULA Lamarck.

Comatula micraster sp. nov.

Type.—Cat. No. Z. E. V. [illegible], Indian Museum; Andaman Islands; 60 fathoms.

Centro-dorsal rounded-pentagonal, flush with, or very slightly raised above, the dorsal surface of the radials, without cirri.

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Radials short, trapezoidal, four or five times as broad as long; I Br$_1$ and 2 united by syzygy, the syzygial pair being about twice as broad as long; I Br$_1$ almost entirely or quite united laterally; I Br$_2$ free laterally.

Ten arms 50 mm. to 65 mm. long, resembling, with the pinnules, those of *C. pectinata.*

GENUS COMASTER L. Agassiz.*

Comaster parvus sp. nov.

Type.—Cat. No. Z. E. V. $\frac{883}{7}$, Indian Museum; Andaman Islands; 53 fathoms.

Cirri XIII–XVIII, 10–11, 8 mm. long, arranged in a single or partially double row on a rather thick discoidal centro-dorsal.

Ends of the basal rays visible as prominent tubercles in the angles of the calyx; radials projecting slightly beyond the edge of the centro-dorsal; I Br$_1$ very short and band-like, just in contact basally but widely diverging so that their lateral edges are separated by a broad shallow U-shaped gap; I Br$_2$ (axillary) triangular, twice as broad as long, the anterior angle very acute; II Br 4 (3 + 4), widely separated; III Br 2 (1 + 2); IV Br 2 (1 + 2), developed interiorly in reference to the II Br series, but seldom present.

Forty arms 60 mm. to 70 mm. long resembling, with the pinnules, those of the other small species of the genus.

Mouth central or sub-central; anal tube small, sub-central or marginal; disk naked.

FAMILY HIMEROMETRIDÆ.

Mariametra gen. nov.

Genotype.—Himerometra subcarinata A. H. Clark, 1908.

The form which I described under the name of *Himerometra subcarinata* differs markedly from all the other species in the genus *Dichrometra,* where I had tentatively placed it, in having a delicate narrow carinate line in the middle of the dorsal surface of the division series and first two brachials, and in having the sides of the division series thickly covered with fine granulations forming a triangular figure in each interradial area, with the apex at about the level of the last axillary, something similar to the ornamentation found in certain species of *Crinometra.* There are also differences in the cirri and in the pinnules, and the surface of the disk adjacent to the ambulacra is strongly plated. It did not seem wise to create a genus for this single aberrant species, as it was then impossible to judge of the value of the characters exhibited, they not being met with in any other species of the Himerometridæ. The Indian collection, however, contains another species possessing the same general features which separate *subcarinata* from the remaining species of *Dichrometra,* though differing widely in its details, and I have now no hesitation in creating a genus for these two peculiar forms, which I propose to call *Mariametra.*

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* Cf. *antea,* p. 87.

Mariametra margaritifera sp. nov.

Type.—Cat. No. 57B., Indian Museum; two miles off Great West Torres Islands.

Centro-dorsal rather small, discoidal.

Cirri XXI, 30–34, 15 mm. long, the outer joints with long dorsal spines.

Disk thickly covered with small calcareous plates along the ambulacra and on the anal tube, with scattering plates in the interambulacral areas; no plating after the last axillary.

Radials short, about six times as broad as long, gently convex proximally and correspondingly concave distally; I Br$_1$ short, oblong, somewhat over four times as broad as long, in lateral apposition and slightly flattened; I Br$_2$ (axillary) short, almost or quite triangular, two and one-half or three times as broad as long, in apposition laterally; II Br 2; radials and portion of centro-dorsal above the proximal row of cirrus sockets evenly and thickly covered with high small tubercles resembling those on the dorsal pole of the centro-dorsal, this tubercular modification of the dorsal surface of the joints extending distally in the interradial angles, occupying the lateral third of the I Br$_1$ and the I Br$_2$ and of the II Br series, thence diminishing in width and disappearing on the second brachial; inner edges of the II Br series similarly modified; I Br series with a narrow and low, but prominent, tubercular keel or row of tubercles; this is much less marked or altogether absent on the II Br series and first two brachials, though sometimes traceable to the lowest of the triangular brachials; I Br and II Br series and proximal oblong brachials with prominently everted dentate proximal and distal edges; as the brachials become wedge-shaped and triangular, the everted dentate ends become gradually lower, transforming into a rather prominent finely spinous overlap which slowly dies away distally.

Eighteen arms (in the type) apparently 30 mm. to 35 mm. long, the proportions of the brachials being approximately as in *M. subcarinata*.

P$_1$ 4 mm. long, moderately stout basally, but tapering rather rapidly in the proximal half and slender distally, with twelve joints, the first three squarish, the following increasing in length and becoming about three times as long as broad distally; P$_2$ 6 mm. long, slender, but stouter than P$_1$ and somewhat stiffened, with about sixteen joints, at first squarish, but becoming three or four times as long as broad distally; P$_3$ similar to P$_2$ and about the same size; following pinnules 3 mm. long, small and weak; distal pinnules delicate, 5 mm. long.

FAMILY COLOBOMETRIDÆ.

GENUS CENOMETRA A. H. Clark.

Cenometra herdmani sp. nov.

Antedon bella (not of Hartlaub) 1904. CHADWICK, in HERDMAN, Report Ceylon Pearl Oyster Fisheries, Suppl. Rep. XI, p. 155.

Type.—Cat. No. "[illegible]", Indian Museum; Ganjam Coast, Bay of Bengal; 12 fathoms.

This species resembles *C. unicornis* in general appearance, but is more

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BY AUSTIN HOBART CLARK.*

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The species diagnosed herein will be fully described and figured in one of the series of monographs published by the Indian Museum dealing with the fauna of the Indian Ocean.

FAMILY COMASTERIDÆ.

GENUS COMATULA Lamarck.

Comatula micraster sp. nov.

Type.—Cat. No. Z. E. V. [illegible], Indian Museum; Andaman Islands; 60 fathoms.

Centro-dorsal rounded-pentagonal, flush with, or very slightly raised above, the dorsal surface of the radials, without cirri.

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slender, especially the cirri. It may at once be distinguished from all the other species of the genus by the paired dorsal tubercles on the cirrus joints which are small and situated very close together; and by the shortness and comparative slenderness of P_2, which is very slightly, when at all, longer than P_1; P_2 also has comparatively few joints, these numbering less than twenty.

Cenometra insueta sp. nov.

Type.—Cat. No. 23H., Indian Museum; Arrakan coast, Burma.

With the arm and pinnule structure of the preceding, and the same slenderness of build, this form has the paired dorsal tubercles of the cirrus joints situated with their apices much further apart, about two-thirds the transverse diameter of the joint faces instead of less than one-half as in *C. herdmani.*

GENUS CYLLOMETRA A. H. Clark.

Cyllometra soluta sp. nov.

Type.—In collection of Indian Museum; Straits of Ormuz, at entrance to Persian Gulf; 48–49 fathoms.

This species in its general appearance resembles *C. manca* from the Philippine Islands.

Centro-dorsal thin-discoidal, the bare polar area 2 mm. in diameter.

Cirri XVI, 21–28, 11 mm. to 13 mm. long, the fourth or fifth and following joints subequal, about as long as broad; third or fourth and following joints with produced distal ends, which soon transform into prominent paired dorsal spines, becoming single median dorsal spines on the terminal five or six.

Ray and arm structure as in *C. manca* and *C. albopurpurea.*

Fourteen to sixteen arms 55 mm. long.

P_a absent; P_1 small and very slender, 3 mm. long, with about twelve joints; P_2 the largest and longest on the arm, 11 mm. long with seventeen joints, the first not so long as broad, the third twice as long as broad, the remainder about three times as long as broad; the pinnule is much more slender than the corresponding pinnule in the other species of the genus, and is nearly smooth, the distal edges of the joints in the terminal portion projecting only very slightly; P_3 7 mm. long, similar to P_2 but very slender, the joints distally proportionately somewhat longer; following pinnules more slender still, about 5 mm. long with fifteen joints, and flexible, gradually decreasing in length to 4 mm. and increasing again to 8 mm. distally.

FAMILY TROPIOMETRIDÆ.

GENUS ASTEROMETRA A. H. Clark.

Asterometra mirifica sp. nov.

Antedon longicirra (part) (not of Carpenter) 1893. BELL, Journ. Linn. Soc. (Zool.) vol. **24**, p. 339.

Type.—Cat. No. $\frac{2658}{9}$, Indian Museum; Sahul Bank, in 10° 30′ S. lat., 125° E. long.

While in general similar to *Asterometra longicirra*, this species may be at once distinguished by the presence of a high sharp median keel on the I Br series and on the first two brachials.

Asterometra acerba sp. nov.

Antedon longicirra (part) (not of Carpenter) 1893. Bell, Journ. Linn. Soc. (Zool.), vol. 24, p. 339.

Type.—Cat. No. $\frac{131}{7}$, Indian Museum; Sahul Bank, in 10° 30′ S. lat., 125° E. long.; collected by Capt. F. Worsley of the cable S. S. *Sherard Osburn*.

In general this species comes nearest to *A. anthus* of the Eastern Sea, but it is a more slender species and possesses ten arms only.

Cirri xx, 84–90, 55 mm. long, more slender than those of *A. anthus*.

Radials with a moderately prominent dorso-ventrally elongate median tubercle; I Br series with a faint narrow low median carination.

Ten arms 80 mm. long, slightly more slender than those of *A. anthus*, with slightly longer brachials; arms strongly compressed distally as in that species, but the overlapping spines developed on the brachials are not nearly so long or stout.

Pinnules much longer than those of *A. anthus*, and more slender, with proportionately longer joints, those in the terminal portion being three times as long as broad or even longer whereas in *A. anthus* they do not exceed twice the length: P_1 is 7 mm. long with twelve joints; P_2 similar, 7.5 mm. long; P_3 slightly stouter 8 mm. long; P_5 9 mm. long; distal pinnules 13 mm. long.

FAMILY THALASSOMETRIDÆ

SUB-FAMILY THALASSOMETRINÆ.

GENUS CROTALOMETRA A. H. Clark.

Crotalometra sentifera sp. nov.

Type.—Cat. No. Z. E. V. $\frac{3091}{7}$, Indian Museum; 10° 47′ 45″ N. lat., 72° 40′ 20″ E. long.; 703 fathoms.

This new form is most nearly related to *C. magnicirra* and *C. rustica*; while of the same arm length or even somewhat larger than the latter (150 mm. to 160 mm. arm length) it is more slender, the arms are fewer in number (twelve to sixteen), the cirri are shorter and less stout with fewer joints (xx, 59–62, 50 mm. long), and the brachials after the proximal third of the arm bear long overlapping spines which are more or less flattened dorso-ventrally and rounded or truncated at the tip.

GENUS THALASSOMETRA A. H. Clark.

Thalassometra attenuata sp. nov.

Type.—Cat. No. Z. E. V. $\frac{1091}{7}$, Indian Museum; 22° 24′ 10″ N. lat., 66° 51′ 30″ E. long.; 765 fathoms.

This very slender species appears to be related to *T. pergracilis*, but is much more delicate even than that species.

Centro-dorsal conical, the sides slightly convex, 3 mm. broad at the base and 2 mm. high, the cirrus sockets arranged in ten columns of usually two each, the pairs of columns usually slightly separated radially by a shallow furrow or a coarsely tubercular ridge.

Cirri xx, 62–71, elongated and very slender, 50 mm. long, the longest joints being twice as long as broad, or slightly longer, those after about the twenty-fifth being slightly broader than long; joints after the seventeenth or twentieth with the distal dorsal edge produced into a serrate ridge which soon gives place to small carinate dorsal spines.

Ends of the basal rays visible as small, though rather prominent, tubercles in the angles of the calyx; radials just visible or entirely concealed, sometimes bearing on the dorsal surface a row of small tubercles; I Br_1 very short, widely chevron-shaped, the proximal and outer third of the distal edge somewhat everted and the distal lateral angles more or less produced; I Br_2 (axillary) triangular, twice as broad as long, the anterior edges somewhat everted, the lateral angles more or less produced; II Br 4 (3 + 4), developed in two out of six specimens, the lateral edges of the component joints more or less produced.

Ten to thirteen arms 80 mm. to 90 mm. long, exceedingly slender, having in general more the appearance of those of some slender antedonid than of those of a thalassometrid; first brachial short, wedge-shaped, twice as long exteriorly as interiorly, basally united interiorly, the anterior and posterior edges slightly thickened, the lateral edges somewhat produced, and the antero-lateral angles, both interior and exterior, more or less produced; second brachial similar in size and shape; third and fourth brachials (syzygial pair) usually slightly longer interiorly than exteriorly, half again as broad as, to about as broad as, long; next three or four brachials approximately oblong, twice as broad as long, then becoming triangular, as long as broad, distally slowly increasing in length and becoming wedge-shaped, being twice as long as broad in the outer part of the arm; synarthrial tubercles rather prominent; I Br series and first two brachials smooth dorsally or with a few small low inconspicuous tubercles, usually with slightly spinous lateral borders; following brachials with the dorsal surface studded with very fine short spines or sharp tubercles, which in some specimens are nearly obsolete; at about the end of the proximal fourth of the arm the brachials begin to develop prominent longitudinal striations which increase in frequency and height distally. The proximal oblong brachials have the proximal and distal ends somewhat prominent; after about the twentieth brachial the distal edges begin to overlap, and in the distal portion of the arm the brachials have the distal portion somewhat expanded, giving approximately the same "dice-box" appearance characteristic of the terminal portion of the arms in the Antedonidæ.

The pinnules are essentially as in other species of the genus; but the first three pinnules on each side of the arm are very strongly carinate.

SUBFAMILY CHARITOMETRINÆ.

GENUS PACHYLOMETRA A. H. Clark.

Pachylometra invenusta sp. nov.

Type.—In collection of Indian Museum; 11° 46′ 30″ N. lat., 93° 16′ 00″ E. long.; 569 fathoms.

This species is in general similar to *P. macilenta*, but differs in many details.

Cirri XXIII, 20–21, 30 mm. to 34 mm. long, rather slender as in *P. macilenta*; the proportions of the joints are the same as in that species, but the distal edges of the joints are slightly more thickened, giving the cirri as a whole a somewhat rougher appearance.

Twelve arms (in the type) 170 mm. long, slender, as in *P. macilenta*: the two II Br series are 4 (3+4); the ornamentation of the I Br and II Br series is as in that species; I Br series, first two brachials exteriorly and first three interiorly, in close apposition and sharply flattened laterally, the apposed edges somewhat everted; brachials with the same proportions as in *P. macilenta;* but the proximal sub-quadrangular brachials have the distal ends thickened and everted, and the remaining brachials have rather prominently overlapping distal edges. The distal intersyzygial interval is four or five oblique muscular articulations.

The pinnules resemble those of *P. macilenta*, but the genital pinnules are somewhat more swollen than in that species.

FAMILY ANTEDONIDÆ.

GENUS PSATHYROMETRA A. H. Clark.

Psathyrometra gracillima sp. nov.

Type.—Cat. No. $\frac{4920}{7}$, Indian Museum; 19° 35′ N. lat., 92° 24′ E. long.; 272 fathoms.

This species is even smaller and more delicate than *P. mira*, heretofore the smallest known species of the genus.

Centro-dorsal sharply conical, 4 mm. broad at the base and 2.5 mm. high, separated into five radial areas by five interradial furrows which are somewhat broader than the adjacent cirrus sockets; eight to ten well separated cirrus sockets in each radial area, arranged approximately in four columns, though apparently more or less irregular.

Cirri XL–L, about 25, 35 mm. long, slender, smooth and delicate.

The ten arms which, except for their slenderness, resemble those of related species, are about 100 mm. long.

GENUS TRICHOMETRA A. H. Clark.

Trichometra obscura sp. nov.

Type.—Cat. No. Z. E. V. $\frac{2368}{7}$, Indian Museum; 7° 17′ 30″ N. lat., 76° 54′ 00″ E. long.; 430 fathoms.

Centro-dorsal conical, the sides slightly convex, 3.50 mm. broad at the base and 3 mm. high.

Cirri lacking.

Radials even with the edge of the centro-dorsal; I Br$_1$ very short and band-like, not quite in contact basally, the lateral edges diverging at a rather broad angle; I Br$_2$ (axillary) almost triangular, slightly broader than long, the anterior and lateral angles rather strongly produced, with a rounded posterior process incising the I Br$_1$.

The ten arms resemble those of the other species of the genus so far as can be judged from the single mutilated specimen. The longest stump measures 9 mm. to the tenth brachial.

FAMILY PENTACRINITIDÆ.

GENUS HYPALOCRINUS A. H. Clark.

Hypalocrinus liliaceus sp. nov.

Type.—In collection of Indian Museum; 16° 25′ 00″ N. lat., 93° 43′ 00″ E. long.; 463 fathoms.

Hypalocrinus lilaceus is most nearly related to *H. springeri;* the internodals are usually twelve to fourteen in number; II Br 4 (3+4); III Br 2; the elements of the division series and the lower brachials are not strongly everted as in *H. springeri*, but are rather prominently overlapping, this overlap forming a rather sharp point on the side of the brachial which bears the pinnule; this character gradually dies away after the proximal third of the arm, disappearing almost entirely in the outer half. The first syzygy occurs between the second and third brachials as in *Capillaster*.

FAMILY BOURGUETICRINIDÆ.

GENUS BATHYCRINUS Wyville Thomson.

Bathycrinus woodmasoni sp. nov.

Type.—Cat. No. $\frac{84}{7}$ Indian Museum, from 6° 18′ lat., 90° 40′ E. long.; 1,520 fathoms.

This species is nearest to *B. equatorialis* from between the Marquesas Islands and Central America, 2,320 fathoms, but, though considerably larger, it is of a more delicate build.

The type specimen consists of a stem lacking the topmost columnars. Stem (without proximal portion) smooth and slender, enlarging very gradually toward the root, the distal columnars with the articulations not especially swollen, the radicular cirri confined to the terminal columnar; length 327 mm., with one hundred six columnars. Topmost columnar present twice as long as broad, the following increasing to two and one-half times as long as broad on the fourth, then more gradually to three times as long as broad on the fourteenth, and nearly four times as long as broad on the twenty-third and following; length very slowly decreasing after above the fiftieth, the fourteenth from the distal end (root) and following being as long as broad; last seven or eight with the articulations slightly swollen; periphery of the articular faces finely marked with radiating lines except at the ends of the transverse ridge; proximal columnars quite cylindrical, the articulations becoming slightly enlarged after the thirtieth; squarish lower joints slightly constricted centrally as in those species of *Phizocrinus* which have squarish columnars; radicular cirri stout, but only the bases preserved. The topmost columnars are 1 mm. long by 0.5 mm. in diameter; those in the middle of the stem are 4 mm. long by 1 mm. in diameter, while the squarish ones at the distal end are 2 mm. long; the last seven or eight are 3 mm. long with oval ends the faces of which measure 3 mm. by 1 mm., the two faces of each columnar being approximately at right angles to each other.

Bathycrinus paradoxus sp. nov.

Type.—Cat. No. $\frac{2472}{8}$, Indian Museum; Bay of Bengal; 1,300 fathoms.

The material consists of two broken specimens; one stem, apparently lacking merely the topmost discoidal columnars, 67 mm. in length (thirty-eight columnars), broken into five parts; part of a larger stem, including the root and twenty-one columnars, and a crown without the distal portion of the arms probably belonging to the latter.

Nearest to *B. recuperatus* (Perrier).

Stem very slender; longest columnars of smaller stem 2.5 mm. in length; of larger stem 3 mm.; columnars of middle of larger stem 0.7 mm. broad at the ends, 0.4 in the middle.

Basals five, not anchylosed, forming a basal ring which expands slightly anteriorly, and is about as long as the breadth at the top of the stem; radials forming a ring expanding rather rapidly outward from the basals, the sides evenly concave, two and one-half times as broad distally as proximally, half again as broad distally as long; I Br$_1$ trapezoidal, nearly twice as long as broad proximally; I Br$_2$ trapezoidal, nearly twice as broad as long.

Arms ten, all broken off near the base, smooth, apparently similar to those of other species of the genus; I Br and lower brachials with a broad thin produced border; distal two-thirds of the I Br$_1$ and the following joints with a sharp median keel.

VOL. XXII, PP. 153-156 JULY 28, 1909

PROCEEDINGS
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NEW CLADOCERA FROM NEW ENGLAND.*

BY ALFRED A. DOOLITTLE.

Cooperating with the investigations of the New England Lakes conducted by the U. S. Bureau of Fisheries, the writer has found in the plankton of some of the waters visited two species of Cladocera which do not seem to have been previously described. One of these is the type of a new genus. A more complete description of these species with figures may be looked for at a later date, probably in one of the publications of the United States National Museum.

FAMILY MACROTHRICIDAE Norman and Brady.

GENUS PAROPHRYOXUS gen. nov.

Type.—*Parophryoxus tubulatus* sp. nov.

Oval or eliptical, evenly rounded anteriorly, produced posteriorly, tube-like. Cervical sinus present. Sides concave. With distinct rostrum and keel from near tip of rostrum to near posterior end. Eye and ocellus present. Antennules long, not greatly curved, with lateral sense seta, and distal olfactory setae, otherwise without conspicuous armature. Antennae of female with setae $\frac{0-0-0-3}{0-0-3}$, spines $\frac{0-1-0-1}{0-0-1}$; of male, setae $\frac{0-1-1-3}{0-0-3}$, spines as for female. Labrum with anterior and posterior lobes curved toward each other forming a window-like opening. Maxillae with three teeth; feet, six. Postabdomen slender, triangular, both sides irregularly sinuous. Armature obsolescent, claws long, with two basal spines.

Remarks.—The superficial resemblance of specimens of this genus to *Ophryoxus* disappears on closer examination. It lacks the conspicuous posterior spine, the bristling antennules, the fleshy processes upon the labrum, and the heavy armature of the postabdomen of *Ophryoxus*.

Parophryoxus tubulatus sp. nov.

Type.—To be deposited in the U. S. National Museum, from Anonymous Pond (Crystal Lake), Maine, September 5, 1908. Collected also in Umbagog Lake, Maine and New Hampshire, July-August, 1905; Sebago

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* Published here by permission of the Bureau of Fisheries.

Lake and Thomas Pond, Maine, July-August, 1906, 1907, 1908. Rare in weedy, shallow margins or coves of lakes.

Description.—Female. Oval, evenly rounded anteriorly, dorsal and ventral margins approaching each other and produced posteriorly, tube-like. Dorso-posterior angle acute but not spined; ventro-posterior angle sharp or rounded. Posterior margin low, $\frac{1}{5}$ to $\frac{1}{12}$ height, spinulose.

Keel low, continuous; cervical sinus well developed. Sides of test longitudinally concave from cervical sinus ⅓ the length of the body; upper and lower margins of concavity thickened and ridged. Fornix broad, horizontal limb with sides parallel, curving upward over antennae and eye, and the vertical limb abruptly curving downward to near end of rostrum. Antennules ten times as long as thick; lateral seta ¼ from base; six short olfactory setae, two four times their length and one five times as long; the last nearly equalling the antennule; otherwise armed with very minute denticles and spinules only. Antennae not strong, setae and rami equal, reaching to posterior third. Labrum with fenestrum of size and position to fit the grinding surface of the mandibles. Maxillae with three teeth, the distal sparsely ciliated. Feet very much like *Ophryoxus*. Postabdomen long, tapering to a point, dorsal and ventral margins both irregularly sinuous. The dorsal or anal margin armed with eight to eleven minute spinules distally. Claw ½ the length of the postabdomen, evenly and slightly curved, with two basal teeth, the proximal smaller.

Male. Immature males only have been found, resembling immature females in their greater irregularity of outline, and in other general features, save the antennal formula for setae, which are five on the dorsal ramus, a seta being on each of the second and third segments, additional to the three on the distal segment ($\frac{0\,1\,1\,3}{0\,0\,3}$).

Measurements.—Egg bearing female from Anonymous Pond, Maine, September 5, 1908. Length 1.14 mm.; height .82 mm.; posterior height .12 mm.

FAMILY CHYDORIDAE Leach (LYNCEIDAE Baird).

Chydorus bicornutus sp. nov.

Type—To be deposited in the U. S. National Museum, from Sebago Lake, Maine. Collected in Umbagog Lake, July-August, 1905, Maine and New Hampshire; Sebago Lake, Songo River, Panther Pond, Maine, July-August, 1906, 1907, 1908. Found in small numbers in weedy margins and coves of lakes and lagoon-like arms of rivers.

Description. Female.—Shape of body or test proper from side view, rounded with ventral margin sharply ventricose; from above broadly oval, from the front broadly oval, but sides concave dorsally.

The entire exoskeleton supports a most remarkable development of horns and ridges and cells, somewhat as follows: From each valve of the test there stands out a great horizontal horn, curving slightly posteriorly, often half the width of the body proper. From this horn there run two high ridges forward, and also two ridges over the back from horn to horn. An area on the back immediately anterior to the interspinal ridges is bounded laterally by two other ridges. Near the anterior limit of the area, these ridges, after giving off on each side a high lateral branch, sharply converge and unite in the median line, forming a short crest where head and body meet; then diverging on the head they bound or enclose a large area in front, and continue down to the tip of the rostrum. On the lower half of each valve are four more high ridges, taking their origin near each other at the upper end of the ascending anterior margin of the valve, and running more or less parallel to the margin, but the second and fourth from the margin not running the whole length of the valve. The first and third, however, unite at the dorso-posterior angle, run forward on the back to the interspinal ridges, flaring outward; thus the united ridges of opposite sides bound a dorsal area posterior to the interspinal ridges. Between parallel ridges, except those arising from the lateral horns, there pass partitions, forming large, deep, rectangular cells; within the areas as described are similar cells of various sizes and shapes; laterally above the marginal ridges are other deep hexagonal cells of various sizes.

Eye large, with few facets, ocellus adjacent. Rostrum long, acute, covered with ridges and cells similar to those of the valves. Labrum from side view with anterior lobe blunt, posterior lobe digitate, and ciliated distally. Maxillae with two heavily ciliated teeth. Feet, five, very similar to those of *C. faviformis* Birge, which the deep faviform cells causes it to resemble. Postabdomen broad, rounded distally, with twelve spines on dorsal or anal border. Claw strong, crumbled, basal teeth two, the proximal smaller.

Male, unknown.

Measurements.—Length of body proper about .55 mm., add $\frac{1}{3}$ to $\frac{1}{4}$ for ridges; width, about .45 mm., add [illegible] to [illegible] for horns; height about .50 mm., add. $\frac{1}{4}$ to [illegible] for ridges.

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PROCEEDINGS
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THE SCALES OF SOME AMERICAN CYPRINIDÆ.

BY T. D. A. COCKERELL AND EDITH M. ALLISON.

The sculpture of a Cyprinid scale consists of radiating and concentric lines, which we term *radii* and *circuli*. In *Salmo* only the circuli are found, but in no Cyprinid have we found the radii wholly absent. In the Catostomidæ the radii are both basal and apical, but in the American Cyprinidæ the basal radii are usually absent, while the apical ones are often greatly reduced in number. The circuli are always present, both apical and basal, in these fishes; but in the Characinid *Cheirodon insignis*, from Panama, they are confined to the basal half of the scale.*

The herbivorous genus *Chrosomus* has the radii extending all around the scale, as in *Catostomus*. Among the genera usually referred to Leuciscinæ basal radii occur in *Rhinichthys* and *Agosia*, closely related genera which form a distinct tribe or subfamily. They are also well developed in some, but not all, of the scales of *Leuciscus orcutti*, which thereby stands apart from the other American species ascribed to *Leuciscus*, and nearer to the palæarctic species. The European Miocene *Leuciscus œningensis* (Agassiz) from Œningen, has radii strongly developed all around, a scale very much more like that of *Chrosomus* than those of the ordinary American so-called Leucisci. In the Japanese *Paracheilognathus rhombeus* (Schleg.) there are no basal radii, but the apical radii are strongly zigzag, an extreme exaggeration of a character never more than slightly indicated in the American Cyprinids. Species of *Labeo*, *Chelæthiops*, *Barilius* and *Barbus*, from the River Nile, all have basal as well as apical radii. In *Barbus perince* Rüpp. the scale is large, with few radii, and the basal margin is strongly undulated; a scale extraordinarily like that of the American Catostomid *Carpioides velifer*. *Barbus bynni* Forsk. has a very different scale, with numerous apical radii. In these Old World fishes the circuli are very numerous and regular, whereas in many American forms they become fewer and variously modified. In *Leuciscus* the apical circuli (*i. e.* all apical of the nuclear area)

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* In *Fundulus*, *Apomotis*, etc., the radii are all basal.

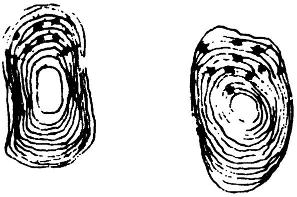


Fig. 1. *Salmo stomias.*
Showing absence of radii.

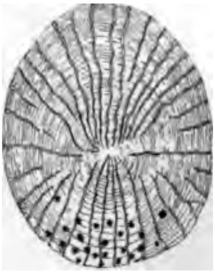


Fig. 2. *Catostomus griseus.*
Showing basal and apical radii.

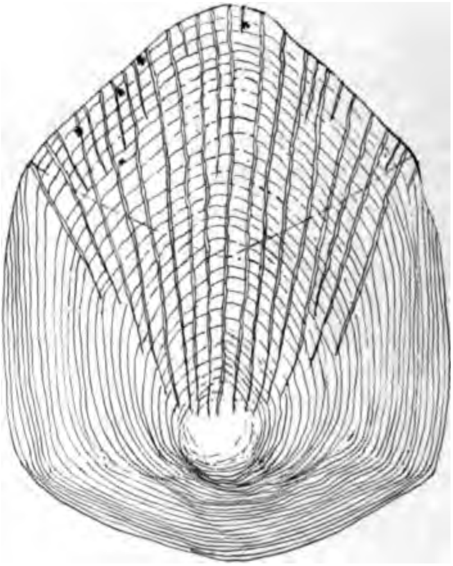
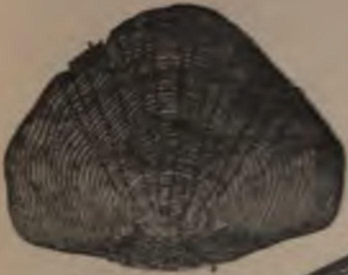


Fig. 3. *Notropis cornutus.*
Showing radii in apical field only.



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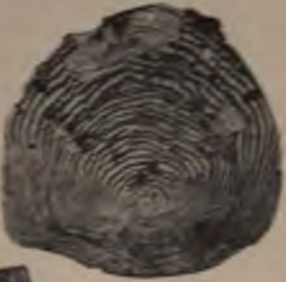

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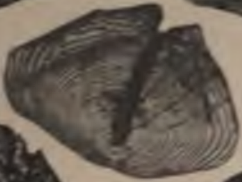

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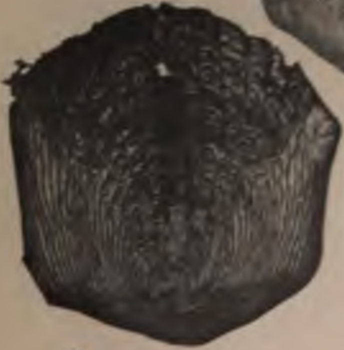

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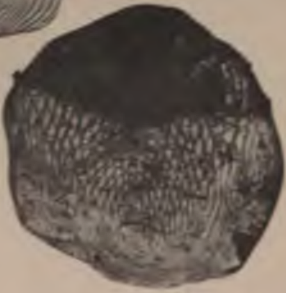

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Scales of American Cyprinidæ.

1. *Ericymba buccata.*—Wild Cat Creek, Ind. Apical circuli flattened.
2. *Ptychocheilus grandis.*—Cache Cr., Calif. Apical circuli flattened, radii few.
3. *Opsopoeodus Osculus.*—Houston, Texas. Apical circuli flattened, radii few.
4. *Semotilus corporalis.*—Norfolk, N. Y. Apical circuli angulate.
5. *Semotilus atromaculatus.*—Cross Lake, Thoroughfare, Maine. Apical circuli angulate, radii many.

are frequently irregular and broken; in *Semotilus* they are further modified, being very distinctly angled in the median line, or inversely V-shaped. *Couesius*, which is almost the same as *Semotilus*, and should stand next to it in the system, has just the same characteristic angled circuli. On the other hand, *Ptychocheilus grandis* is entirely different, with the apical circuli flattened rather than angled medially. *Phenacobius mirabilis* has strongly angled apical circuli as in *Semotilus*, the scales closely resembling those of *Semotilus corporalis*. *Hybopsis gelida* has the circuli as in *Ptychocheilus*, and is not related to *Phenacobius*. *Nocomis kentuckiensis*, usually referred to *Hybopsis*, but certainly not congeneric with it, has angulate apical circuli, as in *Semotilus* and *Couesius*.

In the account of the scales of different genera which follows, it is to be understood that unless the contrary is specified, they have been taken from near the lateral line, at the level of the beginning of the dorsal fin. Scales from other parts of the body will show modifications; thus those on the caudal peduncle are often long and narrow.

Leuciscus Auctt. Amer.

These fishes are probably not congeneric with the European *Leuciscus leuciscus*, but as we do not at present possess any of the Old World species of the genus, we are not in a position to revise the nomenclature. The following key separates the species examined by us:

Basal radii present, though not on all of the scales; basal circuli very much closer and more numerous than in *margarita* (which, though placed by Jordan and Evermann in the same immediate group, is not at all related); apical radii numerous (15 to 29, counting the partly developed ones); *peritoneum* reddish-black, with dots very thickly strewn on a silver ground . . . *L. orcutti* (Eigenmann & Eigenmann).
Santa Ana R., Calif.

Basal radii absent on all the scales . . . . 1.
1. Scale much longer than broad . . . . 2.
Scale subcircular, or broader than long . . . . 3.
2. Scale large; radii numerous (12 to 14); subcentral apical circuli extremely irregular, but not angled: *peritoneum* silvery, with a profusion of small spots, most of them brown, some black
L. nigrescens (Girard).
Alamosa, Colo.

Scale very small; radii less numerous (7 to 9); *peritoneum* brown on a silvery substratum, as in *Orthodon*, and *Acrocheilus*
L. intermedius (Girard).
Tempe, Arizona.

3. Scale very small, with a diameter of about 1 mm. or less . . . 4.
Scale larger . . . . 5.

4. Scale subcircular; radii about 11; *peritoneum* silvery, with scattered pale brown spots and some black dots . . . . *L. aliciæ* (Jouy).
Provo R., Provo, Utah.
Scale broad; radii fewer (9 or 10), without the outer diverging ones seen in *aliciæ; peritoneum* silver, with few diffuse large spots and a few black dots . . . . *L. elongatus* (Kirtland).
Cold Run, Columbiana Co., Ohio.

5. Scale large and thin, with weak sculpture; radii 9 to 12; lateral circuli about 32 on each side in a lateral line scale; *peritoneum* silvery with many dark spots, the small ones black, the larger brown
L. hydrophlox (Cope).
Ross Fork, Pocatello, Idaho.
Scale broad; radii 12 to 14; *peritoneum* silvery, with few scattered spots
L. balteatus (Richardson).
Green Lake, Seattle, Wash.; Elk Creek, Oregon.
Scale circular, or approximately so, sculpture distinct . . . . . 6.

6. Scale rather large; circuli more numerous than in *balteatus;* the more central apical circuli distinctly angled, approaching the condition of *Semotilus;* radii numerous (13 to 15); *peritoneum* not or hardly silvery, with rather few irregularly placed spots, some quite large, but not dark . . . . *L. carletoni* Kendall.
Cross Lake, Thoroughfare, Maine.
Scale rather small; *peritoneum* silvery . . . . 7.

7. Radii few (8 to 10); lateral circuli about 30 on each side; *peritoneum* silvery, nearly as in *neogæus,* but with more diffuse large brownish spots . . . . *L. egregius* (Girard).
Willow Creek, Honey Lake Basin, Calif.
Radii more numerous (10 to 13); *peritoneum* silver, with black spots on upper part . . . . *L. neogæus* (Cope).
Eagle Lakes, Maine.
Radii most numerous (15 to 20), but only about 10 complete; circuli about 20 on each side; *peritoneum* silver, with many spots, mostly reddish-brown, some black, none large, the general effect not dark, though the spots are numerous . . . . . . *L. margarita* (Cope).
Cemetery Creek, Watertown, N. Y.

In a general way, the above arrangement is supposed to correspond more or less with the lines of evolution of the species, the more primitive ones coming first. On the whole the subgenera recognized by Jordan and Evermann are supported by the scale characters, with the exception of *L. orcutti*, which is out of place in *Phoxinus*, or at any rate is quite unrelated to *margarita* and *neogæus*. (The latter is supposed to be genuine *Phoxinus.*)

Lavinia Girard.

This genus does not belong to the Chondrostominæ, but is closely related to the American species of *Leuciscus*. The teeth are only in one row, but they are distinctly hooked. It seems probable that the genus is derived from the American *Leuciscus*, rather than the reverse.

The scales of *Lavinia exilicauda* Baird & Girard (Coyote Creek, Calif.), are so like those of *Leuciscus hydrophlox* from Idaho that we can not find any satisfactory difference. The basal circuli are more indistinct and confused in *Leuciscus hydrophlox*, more distinct and separate in *Lavinia exilicauda*, but this is perhaps not constant. The scales of the *Leuciscus* seem on the whole to be broader. The anal fin of the *Lavinia* seems distinctly longer, but this is not constant. The peritoneum of the *Lavinia* is similar to that of *Leuciscus hydrophlox*, but the spots are much more crowded, giving a beautifully marbled effect, with large brown stellate spots and black dots. (This is wholly different from the peritoneum of *Orthodon*, etc.)

The long intestinal canal of the *Lavinia* is a good generic character, but it has probably been acquired independently of the other herbivorous groups.

Rutilus Rafinesque.

R. olivaceus (Cope) stands entirely apart, by its very small scales, with the radii few (7 to 10). *R. thalassinus* (Cope), according to our material from Pit River, Canby, Calif. (Stanford Univ. Coll.), is distinct by the large broad scale, with the rather numerous (11 to 15) apical radii very parallel. The others have the scale large and broad, and are more alike in the form of the radii, which are more convergent, going to a smaller nuclear area than in *thalassinus*. *R. bicolor* (Girard) has the least number of radii (5 to 8), and compared with *R. oregonensis* Snyder has the scale smaller, with the apical radii less spreading. *R. symmetricus* (Baird and Girard) has the basal area smaller than in *R. columbianus* Snyder; the basal area of *columbianus* is much larger than that of *bicolor*. The radii are about 9 to 13 in *columbianus*, and 7 to 11 in *oregonensis*. In *R. symmetricus* we found the radii very variable, 11 to 20, but this includes several different fishes from various parts of California and Oregon, which are at least subspecifically separable into four groups. (These segregates from *R. symmetricus* have been defined and discussed by the senior author, as far as the material permits, but more information is needed before publication. It will especially be necessary to determine the characters of the fishes now regarded as synonymous with *symmetricus*.)

Hybopsis Agassiz and **Nocomis** Gerard.

Nocomis Girard is a distinct genus. The following table separates the species of *Hybopsis* and *Nocomis* seen by us:

Nuclear area broad, apical radii almost parallel; inner apical circuli angulate . . . . *Nocomis kentuckiensis* (Rafinesque).
Stone R., Tenn.

Nuclear area narrow, apical radii convergent . . . . 1.

1. Scale very large, more than 3.4 mm. broad and long; radii 14 to 16 (about 11 complete) . . . . . . *Hybopsis storerianus* (Kirtland).
Red Lake River, Crookston, Minn.

Scale smaller . . . . 2.

2. Apical radii numerous, about 16 to 25 (in this resembling *kentuckiensis*), but only about 10 complete; most of the scales ridged like lateral line scales; circuli not in the least angled apically
H. gelidus (Girard).
Platte R., Grand Is., Neb.

Apical radii fewer than 16 . . . . 3.

3. Scale relatively firm, closely and distinctly sculptured; basal area larger; radii 10 or 11, no short inner ones; distance between radii not so great as in *watauga*, but considerably greater than in *gelidus*
H. altus (Jordan).
Salamanca, Mexico.

Scales relatively thin, feebly sculptured, with the apical radii far apart . . . . 4.

4. Sculpture more distinct; radii 6 to 14, broad, so that they appear as double lines under the microscope
H. watauga Jordan & Evermann.
Tippecanoe R., Delong, Indiana.

Very thin scale, with weakest sculpture; radii short and irregular
H. amblops (Rafinesque).
Wolf R., Tenn.

Hybopsis gelidus does not accord with the subgenus *Erimystax;* it may be regarded as the type of a new subgenus *Macrhybopsis*, the name suggested by the elongated form.

Semotilus Rafinesque.

S. atromaculatus (Mitchill) has the apical radii very numerous (20 to 25), whereas in *S. corporalis* (Mitchill) they are fewer (12 to 15).

Ericymba buccata Cope.

This curious little fish (ours from Wild Cat Creek, Indiana), has a broad scale, somewhat triangular in form, with about 10 apical radii. The scales, however, differ much in shape on different parts of the body. A lateral line scale from caudal peduncle is approximately round; while a subdorsal scale from about 5 mm. anterior to the dorsal fin is very broad, with 22 nearly parallel radii going to a very broad nuclear area.

The circuli are broadly depressed in the apical middle, in the general manner of *Ptychocheilus*, not in the least angulate.

According to the scales, with due regard also to other characters, the arrangement of the American genera seen by us, heretofore referred to Leuciscinæ, should be somewhat as follows:

Agosia
Rhinichthys

Leuciscus
Rutilus

Semotilus
Couesius
Phenacobius
Nocomis

Opsopœodus
Abramis

Ptychocheilus
Gila

Ericymba

Hybopsis
Notropis } derived from Pimephalinæ.
Cliola

Library

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PROCEEDINGS
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NOTES ON A CYPRINODONT (*ORESTIAS AGASSIZII*) FROM CENTRAL PERU.*

BY BARTON WARREN EVERMANN AND LEWIS RADCLIFFE.

The specimens and notes which form the basis for this paper were sent the U. S. Bureau of Fisheries by Dr. S. Austin Davis of the Cerro de Pasco Mining Company, La Fundición, Peru. The fish were taken in March, 1909, and by careful treatment the brilliancy of their coloration has been well preserved.

Regarding their preservation, Dr. Davis writes: "I have tried to prepare them in such a way as to preserve their natural form, without shrinkage, their flexibility and brilliancy. At the moment of shipment I think I have succeeded fairly well. The process was as follows: They were placed, freshly caught and alive, in a solution of formalin 1–2000 and chloral hydrate 1–1000 and left for four to five days. The coagulated slime was then gently removed and the solution strengthened to 1–1000 formalin. This solution was removed weekly or as it became discolored. No alcohol or any other preservative used other than stated."

Describing the waters from which the specimens were obtained, Dr. Davis says:

"Approximately at the intersection of 11° S. lat. and 76° 10′ W. long., touching the N. E. corner of the great Pampa of Junin, with an elevation above the Pacific of 13,500 feet, there is a small plain. From the sides of the low range of hills which almost enclose it arise a few tiny rills. These join near the only break in the enclosure shortly to empty into a more considerable stream, the Huaracaca, itself finally uniting with the Montaro, which is the outlet of Lake Junin. The Montaro, through other streams, becomes part of the Ucayali, one of the larger tributaries of the Amazon. The initial rivulets first named, may thus be considered as the very headwaters of the Amazon from this district: and from these sources, which may be called La Fundición, come the fish in the parcel so marked.

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"About three miles to the northeast is the shallow lake 'Angascancha,' elevation 14,200 feet, from which were taken the larger sort of fish as well as the smaller variety resembling those from La Fundición. The natural outlet of Lake Angascancha once discharged into the Huaracaca a short distance below the junction with the latter of the waters from La Fundición, but with the establishment a few years since of the smelting plant of the Cerro de Pasco Mining Co., the water from Angascancha is now siphoned over a low ridge to a reservoir for the use of the smelter. Fishes from Angascancha may now be found in the supply ditch and in the reservoir. Although fish from La Fundición and the smaller variety from Lake Angascancha are evidently of the same species, none of the larger sort is to be found in La Fundición; yet not long since there must have been easy communication between these waters. Kept in a glass aquarium, supplied with the weeds and running water in which they live naturally, the fishes from La Fundición keep in good condition indefinitely, while the larger fishes from Lake Angascancha, placed in the same aquarium, soon die.

"Of the larger sort of fishes from Lake Angascancha, a trial was made of their food qualities, but their bones are too hard. It may be stated that these might be softened by pickling, but even then the character of their food produces an inferior sort of flesh resembling that of mudsuckers."

The collection contains 65 specimens, 2 to 7.8 cms. long, from La Fundición, Peru, at an elevation of 13,500 feet in the extreme headwaters of the tributaries to the outlet of Lake Junin, in approximately 11° S. lat., 76° 10′ W. long. The streams are narrow but deep and ditch-like, with clean bottom, plenty of water plants, and clear, rather rapid current. By dissection, spawn was found in these fish in November, but none in February. The stomachs contained gnats in all stages, flies and water insects.

These little fish were plentiful and could be caught by hand. They are rather lively swimmers and get their food anywhere but from the bottom.

From Lake Angascancha we have 101 specimens, 2.9 to 10.1 cms. long.

Lake Angascancha is a shallow lake about 3 miles northeast of La Fundición and at 14,200 feet elevation. The bottom is of soft mud throughout and with plenty of water plants. The fish were very plentiful and easily caught by hand in the weeds. They feed on insects and vegetation. Their breeding season appears to be in mid-winter.

Orestias agassizii Valenciennes.

This species was first described by Valenciennes in Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 178 (275), 1846. *O. tschudii* Castelnau, in Exped. Anim. Amer. Sud, 51, pl. 27, fig. 1, 1855; *O. owenii* (in part) Günther, Cat., VI, 330; *O. ortonii* Cope and *O. frontosus* Cope, in Journ. Phila. Ac. Sci., 2d series, VIII, 186, 1875, as stated by Garman, are probably synonymous names for this species. Prof. Garman in his Fishes and Reptiles of Lake Titicaca in Bull. Mus. Comp. Zool., III, 1-16, pp. 273-6, 1871-6 (1876), adds some additional notes and in "The Cyprinodonts" in Mem. Mus. Comp. Zool., XIX, No. 1, 1895, describes the species more in detail. Pellegrin in Notes on the Fishes of Lakes Titicaca and Poopo, in Soc. Zool. France, XXIX, 90-6, 1904, attempts to subdivide the species into four varieties based on their coloration and reinstates *O. tschudii* indicating that the latter has more dorsal and anal rays, more scales in lateral line and a difference in the size of the eggs. The specimens of *O. tschudii* upon which he bases this distinction are larger than the specimens of *O. agassizii* with which he compares them. In his "Les Poissons des Lacs des Hauts Plateaux de l'Amerique du Sud," pl. XIV, figs. A-D, 1907, he figures the four varieties of *O. agassizii*. Starks in a paper entitled "On a collection of Fishes made by P. O. Simons in Ecuador and Peru," in Proc. U. S. Nat. Mus., XXX, 780, 1906, calls attention to the variability of scaling on the area in front of pectoral and the fact that in his specimen the head was longer than stated by Garman.

For purposes of comparison we give comparative measurements of a series of 10 specimens from Lake Angascancha, 5 from La Fundición, 2 from Lake Titicaca (collected by Dr. R. E. Coker) and one specimen from Bolivia (U. S. Nat. Mus. No. 53,516).

Lake Angascancha Specimens.

	Length in cms.	Head in length	Depth in length	Eye in head	Snout in head	Inter-orbital in head	D.	A.	Scales in l. l.
1	10.1	3.30	4.10	4.14	4.13	3.10	14	15	32
2	9.6	3.63	4.70	4.88	4.00	3.38	13	14	34
3	9.0	3.42	4.05	3.50	4.03	3.50	13	14	32
4	8.9	3.57	4.20	3.17	4.00	3.33	14	15	31
5	8.8	3.40	4.29	3.41	4.10	3.01	13	14	33
6	8.7	3.33	4.26	3.80	4.04	3.00	13	14	31
7	8.0	3.40	4.25	4.87	4.06	3.25	14	13	33
8	7.7	3.05	3.81	3.44	4.00	3.33	13	14	30
9	6.0	3.76	4.90	3.51	3.71	3.17	13	13	
10	5.4	3.51	4.25	3.42	4.00	3.00	13	14	32

Lake Titicaca Specimens.

11	7.0	3.56	3.45	4.00	4.00	3.00	14	15	31
12	6.7	3.37	3.00	4.00	4.00	2.90	14	15	32

La Fundición Specimens.

13	8.0	3.42	4.06	3.95	3.95	3.16	14	14	33
14	6.9	3.27	3.85	4.12	4.12	3.43	14	15	33
15	5.4	3.38	4.40	4.00	4.33	3.25	14	16	32
16	4.2	3.23	4.25	3.62	3.62	3.27	14	15	30
17	2.2	3.60	5.14	2.63	3.33	2.63	13	14	

U. S. Nat. Mus. Spec. No. 53,516, from Bolivia.

18	16.5	3.77	3.08	4.80	3.27	2.66	15	15	34

The scales in the largest specimens are large, convex, horny and smooth anteriorly, becoming smaller, flattened and finely striate posteriorly; those above pectoral and on sides and top of head are polished; those on sides of caudal peduncle more or less deciduous in some specimens; breast and belly naked; top of snout and an area around eye, more or less scaleless. Scales in transverse series 14 or 15; 20 on median line of back between nape and origin of dorsal; those on cheek arranged in 3 or 4 rows. In young individuals, the scales are all very thin, finely striate and not polished.

Head and shoulders broad, heavy and arched in adults, much more compressed in the young; mouth small, nearly vertical; cleft of mouth extending to lower level of orbit. This character is subject to considerable variation; in adults it may reach a considerable distance below level of orbit. Jaws with two series of small, simple, conical, hooked teeth; those in the inner row fewer and smaller; in young examples often none or only one or two of the inner series visible.

Origin of dorsal in advance of anal, slightly nearer caudal than base of occiput, situated at distance equal to its base from caudal; caudal truncate or slightly rounded; ventrals absent.

Color in spirits: 20 specimens 5.5 to 10.1 cms. long, from Lake Angascancha and 10 specimens, 5.0 to 7.6 cms. long, from La Fundición, are dusky olive on back and sides; ventral surface white or yellowish-white, the duskiness of the sides encroaching on this area in the older examples; in some specimens some of the scales on sides, especially on the head and caudal peduncle have light centers with dusky edges. Some of the La Fundición specimens have a broad indistinct dark band on sides, margined below with yellow; dorsal and anal dusky, without black areas or blotches; base of dorsal usually jet black; caudal and pectoral dusky to lightish, axil and base white or dusky white, margined with dusky. All of our specimens over 6.0 cms. long have this coloration, and are Pellegrin's var. *inornata*.

Two specimens, 4.1 to 4.3 cms. long, from Lake Angascancha resemble closely the preceding but differ in having a black line from opercle to base of caudal, most distinct on caudal peduncle; body below line yellowish white with occasional very slight traces of dusky; dorsal and caudal with a few irregular black areas on rays near base, giving the fin a punctulated appearance. These agree quite closely with the description and figure of Pellegrin's var. *typica*.

Thirteen specimens, 2.8 to 5.0 cms. long, from Lake Angascancha differ from those just described in having the horizontal line darker and a row of about a dozen irregular black spots along each side of the back; occasionally two of these meet forming a saddle across the back; below these and alternating with them in some specimens there is a second row; the dark blotches on dorsal and caudal are more pronounced and extend nearer to the free margin. These agree quite closely with Pellegrin's description and figure of var. *senechali*.

Seven specimens, 3.4 to 6.0 cms. long, from Lake Angascancha and 9 specimens, 2.6 to 5.9 cms. long, from La Fundición have the ground color much lighter with 3 or 4 rows of irregular dusky or black blotches on sides, these replacing the horizontal line often more or less coalescent especially posteriorly; in some specimens the dorsal and caudal are only lightly dotted with dusky, in others the spots are almost jet black; pectoral and anal as a rule are much lighter colored in these specimens. The fishes taken at Lake Angascancha are much darker than those from La Fundición. Pellegrin's description and figure of var. *crequii* appears to agree very well with these.

Ten specimens, 2.4 to 5.4 cms. long, from Lake Angascancha and 42 specimens, 2.0 to 6.0 cms. long, from La Fundición are intermediate between the first and fourth lots just described, *i. e.*, between Pellegrin's var. *inornata* and var. *crequii*. Some of these show very obscure traces of spots on back, and have a few dusky spots on dorsal and caudal; others differ from var. *inornata* only in having a few spots either on dorsal or caudal or on both. There are so many varying stages among these that we are unable to separate them.

Two specimens, 3.7 and 4.4 cms. long, from Lake Angascancha and 2 specimens, each 4.3 cms. long, from La Fundición are intermediate between the second and third lots described, showing posteriorly very obscure traces of two or three dusky blotches. These are intermediate between var. *typica* and var. *senechali* of Pellegrin.

Forty-seven specimens, 4.2 to 5.9 cms. long, from Lake Angascancha and 2 specimens, 4.0 and 4.6 cms. long, from La Fundición are intermediate between our third and fourth lots, *i. e.*, between Pellegrin's var. *senechali* and var. *crequii*. In some of these the black spots on sides have become coalesced to such an extent that they form three parallel black bands with two alternating light bands between them; the central black band typical of Pellegrin's var. *typica* is wider and more pronounced in color in these specimens. Others have dusky or black spots below black lateral stripe.

We have examined also two examples of this species collected in Lake Titicaca near Puno, July 28, 1908, by Dr. Robert E. Coker. They are not so slender as our specimens and it is probable, as is indicated in the table of comparative measurements, that the head and depth are more nearly equal in living examples of this size. They have the general coloration of our specimens over 6.0 cms. long but the dorsal and caudal are punctulate with darker. In the smaller one there is a dusky line bordered on either side with white, passing through the center of the dorsal fin.

After careful study of these specimens, in all of which the colors have been well preserved, we feel confident that specimens of *Orestias agassizii* from this region will not admit of such a separation as that offered by Pellegrin. That different conditions markedly affect their brilliancy of coloration is evidenced by the specimens in our collection. The young (under 6.0 cms.) from shallow Lake Angascancha with still water and mud bottom are much darker than those of the same size taken from the clear, narrow, deep and rapid streams around La Fundición. The latter do not show such marked differences and tend to conform much more closely to the adult in color and general appearance.

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PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

A NEW WARBLER FROM THE BAHAMA ISLANDS.

BY W. E. CLYDE TODD.

From December, 1908, to May, 1909, Mr. Willis W. Worthington of Shelter Island Heights, New York, was engaged in collecting natural history specimens in the Bahama Islands, his material coming to me at the Carnegie Museum. He was especially successful in securing specimens of the rarer and more interesting Bahaman birds, among them a remarkable new species of warbler which, in advance of a formal report on the collection as a whole, I propose to call:

Dendroica flavescens sp. nov.

YELLOW-BREASTED WARBLER.

Type, No. 19,887, Collection of W. W. Worthington, adult male; Spencer's Point, Abaco, Bahama Islands, May 7, 1909; W. W. Worthington.

Specific Characters.—Similar to *Dendroica dominica* Linnaeus, but bill longer and slightly decurved, and entire lower parts (except under tail-coverts) yellow.

Description.—Adult male: above plain slate-gray (duller than in *D. dominica*); wings and tail dusky black with slate-gray edgings, the middle and greater coverts tipped with white, forming two conspicuous bands across wing; two outer rectrices with inner webs extensively white, and a more or less distinct white spot on third rectrix also; auricular and post-orbital regions, rictal streak, and lores black; forehead and sides of crown sometimes (always in full plumage?) black; suborbital spot and superciliary stripe white, the latter becoming pale yellow anteriorly; a small patch on sides of neck, behind the auriculars, white; below pale yellow, brightest on the throat and breast, fading to nearly white on the lower abdomen and under tail-coverts, the sides streaked broadly with black, confluent with the black auricular patch; under tail-coverts obscurely streaked with dusky; under wing-coverts white; bend of wing tinged with yellow; bill black; feet dusky (in skin). Adult female similar, a little duller, the back slightly washed with olivaceous. Immature female (first nuptial plumage) similar, but still duller in general coloration.

MEASUREMENTS (in millimeters).

No.	Sex.	Locality.	Date.	Wing.	Tail.	Exposed culmen.
19785*	♂ ad.	Sand Bank, Abaco . .	April 26, 1909	66	54	17
19887*	♂ ad.	Spencer's Point, Abaco	May 7, 1909	63	52	16
26047†	♂ ad.	"Abaco"	June 13, 1891	65	53	17
19672*	♀ im.	Sand Bank, Abaco . .	April 24, 1909	59	52	17
19825*	♀ ad.	Sand Bank, Abaco . .	April 29, 1909	63	53	16.5

* Collection W. W. Worthington.
† Collection Field Museum.

Remarks.—Four specimens of this fine new species were secured by Mr. Worthington, while I have recently discovered a fifth in the collection of the Field Museum of Natural History, whose series of *Dendroica dominica* has been placed at my disposal through the courtesy of Mr. Charles B. Cory. So far as known it is confined to the pine barrens of Abaco, but may be expected to occur on Great Bahama Island also. It is evidently most closely related to *Dendroica dominica*, from which it may readily be distinguished by the decidedly longer bill and the extension of the yellow over the entire under parts. This yellow color is much paler, less orange, than in adult specimens of *D. dominica*. The bill is an exaggeration of that of this latter species, being longer and appreciably more decurved, approaching in some degree that of *Cyanerpes* among the Cœrebidæ. The remarkable character of this member, so very different from that of the type of *Dendroica* (*D. coronata*), would indicate that the present bird is one of the most aberrant members of that genus, and would favor the recognition of *Neodendroica*, proposed by Mr. Charles J. Maynard (Warblers of New England, part 4, 1901, 69) for *D. dominica*..

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PROCEEDINGS
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SEP 21 1909

NEW GENERA AND HIGHER GROUPS OF UNSTALKED CRINOIDS.

BY AUSTIN HOBART CLARK.

The recent increase of our knowledge in regard to the inter-relations of the various genera and species of comatulids has indicated that there are a number of well-defined groups which it would be advantageous to recognize in nomenclature in order that their relationships may be the more readily understood.

In my work upon the phylogenetic significance of the syzygy I brought out the reason why the syzygies are always associated with the *oblique* type of muscular articulation while with the *straight* type only synarthries ("bifascial articulations") are found. Two important exceptions to this rule are found in the Comasteridæ in the genera *Comaster* and *Comatula*; in the former all the non-muscular articulations, except the second, occurring in the division series, and the first articulation of the free arm, are supposed to be syzygies, while in the latter the primibrachs and secundibrachs, as well as the first two brachials, are always described as syzygially united. Now according to the phylogeny of the syzygy as I understand it the occurrence of syzygies proximal to the third brachial of the free arm is quite anomalous and can not be logically explained. These two genera, therefore, have caused me considerable uneasiness, and it was with some impatience that I awaited material available for dissection in order to confirm or to disprove the anomalous structure of the animals. I have now at hand a large series of *Comatula pectinata* and *Comaster novæguineæ* from the Philippine Islands. In *Comatula pectinata* I find that the supposed syzygies between the primibrachs and first two brachials are in reality synarthries, though the union is very close and certainly appears syzygial in an external view. Dr. P. H. Carpenter's "*Solaris* group" of "*Actinometra*," therefore, is seen to be identical with his "*Echinoptera* group," provided that the other species agree with *C. pectinata* in structure, which they probably do. In *Comaster* I likewise found no syzygies proximal to the free arm; but here the synarthries, extremely close as in *Comatula*, have secondarily taken on a more or less irregular concentric or radiating, or a combination of both, surface sculpture, which is never so perfect as to conceal entirely the fundamental dorso-ventral synarthrial ridge. This type of articulation, curiously like a syzygy, though directly derived from the totally different synarthy, I propose to call a *pseudo-syzygy*. The Comasteridæ are now shown to contain no exceptions to the rule that syzygies are associated only with *oblique* muscular articulations, synarthries only with *straight* muscular articulations, though we still have, as our now single exception, the strange family Zygometridæ.

The large group Comatulida may be divided into three suborders as follows:

Comatulida Innatantes.

Pelagic comatulids in which the basals are not metamorphosed but form an integral part of the body wall; the infrabasals are not united with the central plate, but usually form part of the body wall; occasionally, through individual variation, they are absent; there is no evidence of attachment at any stage, so that their central apical plate may possibly represent the dorso-central instead of the centro-dorsal of other comatulids. The plates of the calyx, which is very large and more or less globular, are very thin.

Included families.—*Marsupitidæ; Uintacrinidæ.*

Comatulida Oligophreata.

Bottom inhabiting comatulids, stalked when young; basals metamorphosed into a rosette; infrabasals unknown; cavity in the centro-dorsal containing the chambered organ and overlying structures very small; a well-developed neurilemma is present, at least in some forms; the disk is more or less studded or even completely covered with large calcareous concretions or plates; the pinnules, at least the lower, are wholly or in part prismatic, and are composed of short segments; the post-radial series usually divide two or more times.

Included families.—*Comasteridæ; Zygometridæ; Himerometridæ; Colobometridæ; Thalassometridæ; Tropiometridæ.*

Comatulida Macrophreata.

Bottom inhabiting comatulids, stalked when young; basals usually metamorphosed into a rosette; infrabasals have been detected in two species, where they fuse with the centro-dorsal; cavity in the centro-

dorsal containing the chambered organ and overlying structures large; there is no neurilemma; the disk is naked, or studded with minute plates which may fuse into larger plates in the interradial angles; pinnules all cylindrical or more or less flattened, and slender, and with very long segments; the post-radial series do not divide, or divide but once.

Included families.—*Antedonidæ; Atelecrinidæ; Pentametrocrinidæ.*

The family Comasteridæ falls naturally into the three following subfamilies:

Capillasterinæ sub-fam. nov.

The distal cirrus segments bear dorsal processes; in genera containing species with more than ten arms the arm division is extraneous or compound, never interpolated.

Included genera.—*Nemaster; Capillaster; Neocomatella; Comatella; Comatilia; Leptonemaster; Comissia.*

Comactiniinæ sub-fam. nov.

The cirrus segments are entirely smooth dorsally; the segments of the genital pinnules are extremely short and more or less produced distally; more than ten arms are rare; when present the division series are interpolated, and of two ossicles.

Included genera.—*Comatula; Comactinia; Cominia.*

Comasterinæ sub-fam. nov.

The distal cirrus segments bear dorsal processes; two or more division series are present, always interpolated; a few at least of the division series always consist of four ossicles.

Included genera.—*Comaster; Comanthus.*

The family Himerometridæ, as previously understood, may be advantageously sub-divided as follows:

Pontiometridæ fam. nov.

Oligophreate comatulids in which the oral pinnules are greatly elongated, slender, and flagellate, without combs distally; the mouth is approximately central, the anal tube slender and very long; the articular faces of the radials are entirely and widely separated and as deep as broad, well rounded; the central canal bisects the transverse ridge dorso-ventrally; the transverse ridge bears on each side of the central canal a triangular ligament pit which may be called a *fulcral ligament fossa;* there are no muscular fossæ on the radial faces.

Included genus.—*Pontiometra.*

Himerometrinæ sub-fam. nov.

The second division series (usually present) is always of four ossicles, at least in part; the brachials are very, often excessively, short.

Included genera.—*Amphimetra; Himerometra; Craspedometra; Heterometra.*

Stephanometrinæ sub-fam. nov.

The brachials are of moderate length, wedge-shaped; at least one of the proximal pinnules is very stiff, sharp-pointed, and spine-like, with comparatively few segments; the division series and first two brachials have lateral projections, and are well separated; second division series are always present, and, like all the other division series, of two components.

Included genera.—*Oxymetra ; Stephanometra.*

Mariametrinæ sub-fam. nov.

The brachials and division series are as in the Stephanometrinæ, but the division series are in close lateral apposition, without lateral processes; the elongate proximal pinnules are enlarged, but are flagellate, at least distally, and have comparatively numerous segments.

Included genera.—*Mariametra ; Dichrometra.*

The family Antedonidæ falls naturally into six sub-families, as follows:

Antedoninæ sub-fam. nov.

The few cirri are short, with few segments, irregularly disposed on a low-hemispherical centro-dorsal; an opposing spine is present on the penultimate cirrus segment.

Included genera.—*Antedon; Mastigometra; Compsometra; Iridometra.*

Perometrinæ sub-fam. nov.

One or more of the lower pinnules is absent; the cirri, which have numerous segments, shorter distally than proximally, are numerous, and are evenly distributed, closely crowded, on a hemispherical or more or less conical centro-dorsal.

Included genera.—*Perometra; Erythrometra; Hypalometra.*

Zenometrinæ sub-fam. nov.

The cirri, which are long with numerous segments, are arranged in definite columns, usually well separated, at least laterally, on a more or less elongate conical centro-dorsal to which they are weakly attached; some of the lower pinnules may be absent.

Included genera.—*Zenometra; Psathyrometra; Leptometra; Adelometra; Balanometra.*

Heliometrinæ sub-fam. nov.

The numerous cirri, which are slender to moderately stout, have numerous segments which are much shorter distally than proximally, and are evenly distributed over and closely crowded on a large hemispherical or rounded conical centro-dorsal; all the pinnules are present.

Included genera.—*Promachocrinus; Heliometra; Trichometra; Hathrometra; Isometra.*

Thysanometrinæ sub-fam. nov.

The first pinnule is composed of numerous squarish or round segments, but in one genus is much reduced in length; the following pinnules are long, at least as long as the first, with elongated segments; the cirri are long, compressed, deciduous, the distal segments slightly or not at all shorter than the proximal; no dorsal spines; opposing spine absent, rarely feebly developed.

Included genera.—*Eumetra; Thysanometra; Coccometra.*

Bathymetrinæ sub-fam. nov.

The second pinnule bears a genital gland and, with the following, is as long as or even much longer than the first; the cirri are short with few segments.

Included genera.—*Bathymetra; Thaumatometra.*

The following new genera are well worthy of recognition:

FAMILY COMASTERIDÆ.

SUB-FAMILY CAPILLASTERINÆ.

Neocomatella gen. nov.

Comatella (part) 1908. A. H. CLARK, Smiths. Miscell. Coll. (Quarterly Issue), vol. **52**, p. 207.

This is the Atlantic representative of the Pacific genus *Comatella* from which it differs in its fewer arms and much longer brachials which are triangular and about as long as broad instead of short wedge-shaped or discoidal. *Neocomatella* holds approximately the same relationship to *Comatella* as *Nemaster* does to *Capillaster*.

Genotype.—*Antedon alata* Pourtalès, 1878.

FAMILY TROPIOMETRIDÆ.

Pterometra gen. nov.

Ptilometra (part) 1908. A. H. CLARK, Smiths. Miscell. Coll. (Quarterly Issue), vol. **52**, part 2, p. 224.

This genus appears to represent the Australian genus *Ptilometra* in the East Indies; it differs markedly from that genus in the regular distribution of the cirri, these being arranged in ten definite columns, and in the much more slender pinnules which have longer segments.

Genotype.—*Ptilometra trichopoda* A. H. Clark, 1908.

FAMILY ANTEDONIDÆ.

SUB-FAMILY ZENOMETRINÆ.

Balanometra gen. nov.

Perometra (part) 1907. A. H. CLARK, Smiths. Miscell. Coll. (Quarterly Issue), vol. **50**, p. 357.

The cirri are arranged in ten well-separated and definite columns on a conical centro-dorsal; the first two pinnules are absent.

Genotype.—*Antedon balanoides* P. H. Carpenter, 1888.

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PROCEEDINGS
OF THE
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THE NOMENCLATURAL AUTHORITY FOR *GONIONEMUS MURBACHII*.

BY E. L. MORRIS.

In looking up the name of a small jellyfish from Woods Hole to determine the date of authority, the writer came upon the following synonymy:[*]

"*Gonionemus* A. Agassiz, 1862. Contrib. Nat. Hist. U. S., IV, p. 350. From γωνο. angled, and νημα. thread, 'kneed tentacles.'
Gongnema Haeckel, 1879, System der Medusen.
Gonionemus Murbach, 1895, Journ. Morph., XI, 2.
Gonionemus Murbachii Mayer, 1901, Brooklyn Inst. Sci. Bul., I, 1.
Gonionema A. Agassiz, MSS.
Gonionema Murbachii Perkins, Johns Hopkins Un. Cir., May, 1902."

This implies that the species in question was published by A. G. Mayer in 1901, in distinction from the Gulf of Georgia species named by A. Agassiz in 1862.

Having been unable to find the specific binomial in any index consulted at the time, the references in the above quoted synonomy were carefully considered, with the following observations:

Murbach, 1895 (*loc. cit.* pp. 493-495), quoted sufficiently from Agassiz's diagnosis of *Gonionemus vertens* A. Agassiz to establish his (Murbach's) application of Agassiz's binary name. This quotation he supplemented and corrected by a full description of his own observations on the medusae, their habits, size, parts, colors, sexes and reproductive cells.

Mayer, 1901 (*loc. cit.* p. 5), in a paper on "Variation of a Newly-arisen Species of Medusa" (*Pseudoclytia pentata*†), refers to variations of other Hydromedusae. In this comparison, speaking of Hargitt's work, he noted "In Gonionenus [*sic*] (G. Murbachii) of Woods Holl, Massachusetts," etc., and in a footnote says: "This species has been commonly called Gonionemus vertens, but it is quite different from G. vertens, A. Agassiz, of the Gulf of Georgia. I propose for it the name of G. Murbachii, in honor of its discoverer, Dr. Louis Murbach."

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[*] Perkins, 1903, in: Proc. Phila. Acad. Nat. Sci. **54** (1902), 750-790, *t. 31-34, f. 1-27.*

† Mayer, 1900, in: Bull. Mus. Comp. Zool. Harv. Coll., **37**, 53.

H. F. Perkins, in June, 1902,* described "Budding in the Larvae of *Gonionema Murbachii.*" Perkins, again, in 1903 (*loc. cit.*), discusses "The Development of Gonionema Murbachii." In this paper he notes "the first printed account of the Woods Hole species of Gonionema," giving proper reference to Murbach's paper of 1895. He then states that "It was not until 1901 that the specific name *Murbachii* was bestowed upon it by Dr. A. G. Mayer." The remainder of his paper takes up the physiological and morphological characters in the development of the individuals.

Or again:

Murbach, 1895 (*loc. cit.*), evidently fixes the morphological characters, which he discusses, under the binary name of *Gonionemus vertens.*

Mayer, 1901 (*loc. cit.*), evidently intended to distinguish the Woods Holl species from the Pacific Coast species named long before by Agassiz, by the expression "(G. Murbachii)." However, there is no description of the species in connection with this binomial. His footnote, as quoted above, refers to a difference in this species from *G. vertens*, and he properly indicates the man in whose honor this species is named. He does not, however, give any reference to a previously published description; and it is not clear by the details of this record, nor of Murbach's own paper, that Dr. Murbach was the first (*vide infra*) to collect the species at Woods Holl. As generally understood, according to extant codes of nomenclature, this publication of "(G. Murbachii)" is a *nomen nudum.*

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* Perkins's Synonomy as quoted above cites the Johns Hopkins University circular as for May, 1902. The following establishes the correct date of publication:

" THE JOHNS HOPKINS PRESS.
" BALTIMORE, *Jan. 29, 1909.*

" We have your request of Jan. 26th, and beg to advise you that there was no May 1902 no. of the University Circular; the Apl. 02 was No. 157 and the June No. 158.

" THE JOHNS HOPKINS PRESS,
Baltimore, Maryland."

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PROCEEDINGS
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THE NOMENCLATURAL AUTHORITY FOR *GONIONEMUS MURBACHII.*

BY E. L. MORRIS.

In looking up the name of a small jellyfish from Woods Holl to determine the date of authority, the writer came upon the following synonomy:[*]

"*Gonionemus* A. Agassiz, 1862, Contrib. Nat. Hist. U. S., IV, p. 350. From γωνιο, angled, and νημα, thread, 'kneed tentacles.'
Gonynema Haeckel, 1879, System der Medusen.
Gonionemus Murbach, 1895, Journ. Morph., XI, 2.
Gonionemus Murbachii Mayer, 1901, Brooklyn Inst. Sci. Bul., I, 1.
Gonionema A. Agassiz, MSS.
Gonionema Murbachii Perkins, Johns Hopkins Un. Cir., May, 1902."

This implies that the species in question was published by A. G. Mayer in 1901, in distinction from the Gulf of Georgia species named by A. Agassiz in 1862.

Having been unable to find the specific binomial in any index consulted at the time, the references in the above quoted synonomy were carefully considered, with the following observations:

Murbach, 1895 (*loc. cit.* pp. 493–495), quoted sufficiently from Agassiz's diagnosis of *Gonionemus vertens* A. Agassiz to establish his (Murbach's) application of Agassiz's binary name. This quotation he supplemented and corrected by a full description of his own observations on the medusae, their habits, size, parts, colors, sexes and reproductive cells.

Mayer, 1901 (*loc. cit.* p. 5), in a paper on "Variation of a Newly-arisen Species of Medusa" (*Pseudoclytia pentata*†), refers

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[*] Perkins, 1903, in: Proc. Phila. Acad. Nat. Sci. **54** (1902), 750–790, *t. 31–34, f. 1–27.*

† Mayer, 1900, in: Bull. Mus. Comp. Zool. Harv. Coll., **37**, 53.

"*G. depressum*, Yokohama, Japan. GOTO, S., 1903; Mark Anniversary Volume, p. 12, pls. II., III.[*]"

Mayer's reference to Murbach after the type locality for *G. murbachii* is misleading as implying Murbach's naming the species, if one notes the value of the other citations in this list; and is Mayer's first use of the binomial with reference to previously published description (Perkins's), in lieu of a description by himself.

To give the true facts, the reference should be corrected under *Gonionemus*, as treated by H. B. Bigelow[†] in his paper on Medusae, page 105, February 1909, as follows:

Gonionemus A. Agassiz, 1862.

Since the [original] description of the [type] species of this genus, *Gonionemus vertens*, by A. Agassiz (1862, not "1865"), six additional species have been described: *G. murbachii* Perkins (1902, 1903, not "Mayer 1904"), *G. suvaensis* Agassiz and Mayer (1899), *G. depressum* Goto (1903), *G. agassizii* Murbach and Shearer (1902, not "1903"), *G. pelagicus* Bigelow (1904), and *G. hornelli* Browne (1905). [Bigelow, page 107, cites the last two as synonyms under *G. suvaensis*.]

The bibliography given by Bigelow contains 159 titles; but does not include two or three of those given in the discussion above, referring to priority publication of the species in question.

The above facts have led to the correction of the authority for the binary name *Gonionemus murbachii*, and the corrected synonomy is here presented.

GONIONEMUS MURBACHII Perkins.

Gonionemus vertens Murbach, 1895; *et Auct. Am. prec.*, *nec* Agassiz, 1862.

[*Gonionemus murbachii* Mayer, *nomen nudum*, 1901, Bklyn. Inst. Sci. Bull. **I**, 1. 5.]

Gonionema murbachii Perkins, 1902, Johns Hopkins Un. Cir. No. 158, June, 1902; 1903, Proc. Phila. Acad. Nat. Sci. XI (1902). 750–790, figs. 21; *t. 31–34, f. 1-27.*

Gonionemus murbachii Mayer, 1904, Bklyn. Inst. Mem. Nat. Sci. **I**, 1. 19; *nec* "Murbach."

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[*] Goto (*loc. cit.* p. 20) credits *G. murbachii* to Mayer, by bibliographic reference only.

[†] Bigelow in: Mem. Mus. Comp. Zool. Harv. Coll. **37, 16. p. 105. Feb. 1909.**

VOL. XXII, PP. 183-184 OCTOBER 30, 1909

PROCEEDINGS
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BIOLOGICAL SOCIETY OF WASHINGTON

A PROPOSED DIVISION OF THE PHYLUM ECHINODERMATA.

BY AUSTIN HOBART CLARK.

Many attempts have been made to elucidate the interrelations between the various echinoderm classes, but none of the proposed arrangements have been able to stand the test of critical investigation. I have recently shown that addition to the ambulacral post-radial series of ossicles in the crinoids takes place by the interpolation of ossicles between the first two (the first two brachials of the free arm) and the radials ("interpolated division series"); each division series of two ossicles represents *four* ambulacral plates as found in the urchins; two fuse, forming an axillary, and one disappears, its proximal and distal articular faces being thereby projected upon each other, fusing, and producing the non-muscular articulations by which the components of division series of two ossicles (or of the two pairs in cases where the division series are of four ossicles) are united. The method of ambulacral increase is, therefore, similar in the crinoids and echinoids. In addition, the crinoids add segments monoserially at the extreme tip of their long and slender arms. It has been supposed that this increase was comparable to that of ophiuroids and asteroids, but in reality it is merely a distant analogy, for in the asteroids and ophiuroids the plates are added biserially at the end of the arm, but just proximal to a permanent terminal plate. The ossicles up to and including the second brachial of the undivided crinoid arm are strictly homologous to the entire ambulacral series in an urchin; the remainder of the free arm represents the auricles of the urchin. A critical comparison of the anatomy of urchins and crinoids shows them to be closely related, and very different in almost every way from the ophiuroids and asteroids, which are also similarly closely related. The holothurians belong with the former group. Detailed anatomical evidence of this will shortly be published in the *American Naturalist.*

The following is proposed as the arrangement best showing the interrelations of the classes in the phylum Echinodermata in the light of the most recent knowledge:

PHYLUM ECHINODERMATA.

I. Sub-phylum ECHINODERMATA HETERORADIATA.
    1. Class *Pelmatozoa.*
        a. Sub-class Crinoidea.
        b. Sub-class Cystoidea.
        c. Sub-class Blastoidea.
    2. Class *Echinoidea.*
    3. Class *Holothuroidea* (*Bohadschoidea*).

II. Sub-phylum ECHINODERMATA ASTRORADIATA.
    1. Class *Ophiuroidea.*
    2. Class *Asteroidea.*

VOL. XXII, PP. 185-188 DECEMBER 8, 1909

PROCEEDINGS
OF THE
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DESCRIPTIONS OF THREE NEW SPECIES OF CYPRINOID FISHES.

BY BARTON WARREN EVERMANN AND
THEODORE D. A. COCKERELL.

In the course of some work on the scales of the Cyprinidæ, a few species were found which seem to be new. Three of these are here described; others need to be further elucidated, both as to the constancy of their characters noted, and as to their possible reference to names now placed in synonymy.

The types of the species here described have been deposited in the United States National Museum.

Richardsonius thermophilus sp. nov.

Type, No. 64152, U. S. Nat. Mus., a specimen 68 mm. long.

Type Locality.—Warm Springs, Harney Co., Oregon. Collector, Prof. John O. Snyder, for the U. S. Bureau of Fisheries.

Head 4 in length; depth 4; eye 3.3 in head; snout 4; maxillary 2.75; dorsal 10; anal 11; scales 12–56–7.

Form essentially as in *R. balteatus*; snout very obtuse; scales with very strong circuli.

Color (in alcohol).—Scarcely silvery; back and upper half of side finely punctulate and dark grayish, under parts straw color; peritoneum not silvery, but with large and close diffuse brownish spots.[*]

This fish has been discussed by Prof. J. O. Snyder in Bull. Bureau of Fisheries, XXVII (1907), p. 85. The following description of its colors is given by him:

"Dorsal surface of body deep green; a narrow, diffuse, brassy stripe extending from eye along lateral line, falling below it posteriorly, forming a ventral border to the greenish dorsal area; an indistinct dark greenish stripe extends from eye along the side just below the brassy band; breast and abdomen silvery; sides just below greenish band bright red; snout anterior to eye greenish; cheeks below eye and opercle brassy; fins golden. Immediately after death the greenish dorsal area turns to a steel blue."

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[*] This is probably not a direct effect of the local environments; for *Rutilus columbianus*, from the same Warm Springs, has the peritoneum thickly beset with stellate brown spots, and sprinkled with black dots.

From the particulars given by Prof. Snyder, it is probable that the fish of Silver Creek, Oregon, is the same. Prof. Snyder counted the anal fin rays of 124 examples of *R. balteatus*, with this result:

Number of rays		9	10	11	12	13	14	15	16
Warm Springs specimens.		—	7	20	4	1	—	—	—
Silver Creek	"	2	8	30	18	1	—	—	—
Silvies River	"	—	—	—	2	7	8	13	3

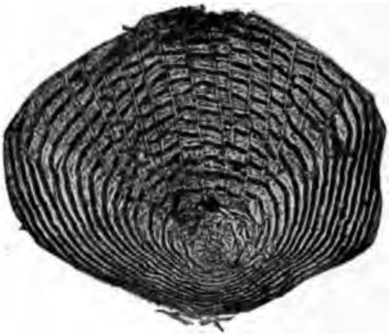

Figure 1.
Scale of *Richardsonius thermophilus*
Evermann & Cockerell, showing circuli.

The generic name *Richardsonius* is used in place of *Leuciscus*, because a study of various species of true *Leuciscus* at the British Museum last summer shows that none of the American species really belongs to that genus, the character of the scales being essentially different. It is equally impossible to use *Phoxinus* for any of the American species, as the true *Phoxinus* (*Leuciscus phoxinus*) has a scale with basal and apical radii, and except for the greater number of circuli, almost the same as that of *Chrosomus*. The American species of "*Phoxinus*" are as far from this type as is possible among the fishes called *Leuciscus*. The specimen of *L. phoxinus* is from Leyn Arenig, Merioneth, 2,000 ft. (*H. E. Forrest;* British Museum Collection).

Notropis kendalli sp. nov.

Type, No. 64150, U. S. Nat. Mus., a specimen 56 mm. long.

Type Locality.—Cross Lake Thoroughfare, Maine. Collector, Dr. W. C. Kendall, July 9, 1903, for the U. S. Bureau of Fisheries.

Compared with *Notropis muskoka* Meek, to which this species is closely related, our fish is a deeper fish; the lateral stripe is much more heavily pigmented (probably not a specific character) and the snout is somewhat longer and more pointed. The very thin scales have fewer radii. Meek described *N. muskoka* as more slender than *cayuga*, which is certainly not true of the Maine fish. It must be supposed that *N. kendalli* and *cayuga* are independent offshoots from the northern *muskoka* stock.

The characters of *N. kendalli* are contrasted with those of other species of *Chriope* in the tables in the paper on *Notropis*.

Notropis universitatis sp. nov.

Type, No. 64151, U. S. Nat. Mus., a specimen* 63 mm. long.

Type Locality.—Boulder Creek, Boulder, Colorado. Collector, Prof. Theo. D. A. Cockerell, 1907.

Close to *N. zonatus*, but with smaller scales and different coloration. There are 45 scales in the lateral line and 9 between the origin of the dorsal and the lateral line, as against 42 and 6 in *N. zonatus*. A pale orange dorsal band on a bright straw-yellow ground, the scales minutely black-dotted, but not appearing dusky margined; sides strongly silvery; lateral line complete; a grayish lateral stripe; dorsal and caudal fins yellowish; dorsal and chin black-speckled.

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* Described as *N. notatus* var. in University of Colorado Studies, April, 1908, p. 170.

VOL. XXII, PP. 189-196 DECEMBER 8, 1909

PROCEEDINGS
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OBSERVATIONS ON THE FISHES OF THE GENUS NOTROPIS.

BY THEODORE D. A. COCKERELL AND OTIS CALLAWAY.

From our study of the scale-characters of the smaller American minnows, combined with those already known, it appears that *Notropis* must have evolved on the North American continent, from some member of the Pimephalinæ. The transition is from *Pimephales* to *Cliola*, and thence to the subgenus *Luxilus* of *Notropis*, especially *N. cornutus*. This indicates an origin for this series independent of the true Leuciscinæ, which must have come from the Old World. According to this view *Notropis* typifies a distinct subfamily Notropinæ, to include *Notropis* and *Cliola*, with *Hybopsis* and perhaps *Phenacobius* forming an aberrant branch. (*Nocomis kentuckiensis* has a very distinct multiradiate scale, and must be excluded from *Hybopsis.*)

Cliola smithii Evermann & Cox (the only species of this genus we possess) has the peritoneum red-brown (not spotted), on a silver substratum, just as in *Orthodon* and *Acrocheilus*. The fish is rather deep-bodied, with rather large scales, approaching *Luxilus*. The gill-lamellæ are very strongly fimbriate. The scales are broad, with numerous (about 19) apical radii, herein agreeing with the Pimephalinæ and with *Luxilus*.

The transition to *Luxilus* is thus sufficiently evident. *N. cornutus* represents the stem-form of *Notropis*, and yet is abundant and wide-spread, showing that it was no failure of this type that led to the production of so many offshoots. The numerous species of *Notropis* seem to be a product of the exuberance of their race, and it may be surmised that some of the minor forms are quite recent, even perhaps post-glacial. In some cases the small size and slender body may doubtless be regarded as an adaptation to smaller streams, enabling the fishes to populate waters unsuitable to the stem-form.

The accompanying table shows the number of apical radii on the scales of the species of *Notropis* examined by us. It must be noted that the scales are all taken from the same part of the fish, namely, the immediate vicinity of the lateral line, at the level of the beginning of the dorsal fin. There is no doubt whatever that by examining a larger number of scales, especially from large series of the fish, the recorded ranges of variation would in almost every case be sensibly increased. At the same time, we are satisfied that with this caution the table may be regarded as of significance in relation to the evolution of the species. It will be observed that two subgenera, as currently interpreted, are in the table separated into divergent parts. In the case of *Cyprinella* we do not believe that a second group is indicated, but in *Hydrophlox* it appears to be necessary to separate *N. coccogenis* as the type of a new subgenus.

NOTROPIS Rafinesque.

Number of apical radii (counting those only partly developed).

(*Luxilus*)	*N. cornutus*	21–27	(*Notropis*)	*N. arge*	10–11
(*Luxilus*)	*N. albeolus*	19–23	(*Chriope*)	*N. bifrenatus*	9–11
(*Coccogenia*)	*N. coccogenis*	16–20	(*Chriope*)	*N. cayuga*	9–10
(*Chriope*)	*N. heterodon*	14–20	(*Notropis*)	*N. swaini*	9–10
(*Chriope*)	*N. muskoka*	18–24	(*Hudsonius*)	*N. gilberti*	9–10
(*Alburnops*)	*N. blennius*	15–18	(*Notropis*)	*N. jejunus*	8–10
(*Hudsonius*)	*N. piptolepis*	14–18	(*Hudsonius*)	*N. illecebrosus*	8–10
(*Cyprinella*)	*N. galacturus*	16	(*Notropis*)	*N. atherinoides*	7–10
(*Hudsonius*)	*N. hudsonius*	11–14	(*Moniana*)	*N. formosus*	6–9
(*Chriope*)	*N. atrocaudalis*	12–13	(*Cyprinella*)	*N. niveus*	8
(*Chriope*)	*N. anogenus*	12–13	(*Cyprinella*)	*N. maculatus*	7–8
(*Moniana*)	*N. lutrensis*	9–13	(*Notropis*)	*N. stilbius*	5–8
(*Notropis*)	*N. scopifer*	11–12	(*Notropis*)	*N. leuciodus*	6–9
(*Alburnops*)	*N. spectrunculus*	10–12	(*Notropis*)	*N. telescopus*	5–7
			(*Hydrophlox*)	*N. zonatus*	6
(*Alburnops*)	*N. scylla*	9–12	(*Hydrophlox*)	*N. chalybæus*	5

Chriope	7–24	*Cyprinella*	8, 16
Alburnops	9–12, 14–17	*Luxilus*	19–27
Hudsonius	9–18	*Hydrophlox*	5–6
Coccogenia	16–20	*Notropis*	5–11
Moniana	6–1		

Coccogenia, subgen. nov.

Type, *Notropis coccogenis* (Cope).

"Mouth large, very oblique, . . . lower jaw projecting beyond upper,

. . . teeth 2, 4–4, 2" (Jordan & Evermann). Fish with silvery sides and no dark band; scales extremely broad, and with very many (about 20) wavy apical radii, ending basally in a very broad nuclear area. (An arrangement resembling that in *Nocomis kentuckiensis* and *Myloleucus thalassinus.*) Specimen studied from Tellico River, Tellico Plains, Tennessee (1893), Dr. Evermann coll. for U. S. Bureau of Fisheries. As a recognition mark, the large black patch on the dorsal fin is worth noting.

N. cayuga atrocaudalis Evermann appears to be worthy of specific rank as *Notropis atrocaudalis.* Dr. Evermann writes assenting to this proposition.

CHRIOPE Jordan.

From a superficial examination of the fish, the following table was constructed:

Snout elongate, its length nearly or quite diameter of eye . . 1.
Snout shorter, obviously less than diameter of eye . . . . . 2.
1. Slender, silvery fish with smaller eye . . . . *N. cayuga.*
Indiana (Lake Maxinkuckee).
Deeper, less silvery fish with larger eye . . . . *N. kendalli.*
Maine.
2. Caudal spot very distinct, not merged in band . . . *N. maculatus.*
Lake Monroe, Fla.
Caudal spot indistinct, or merged in band . . . . 3.
3. Lateral band intense black; iris black . . . . *N. bifrenatus.*
Sebago Lake, Maine.
Lateral band greyish; iris pallid . . . . 4.
4. Scales broadly rounded at apex; eye very large . . . . *N. heterodon.*
Lost Lake, Ind.
Scales more pointed . . . . 5.
5. Profile of nose rounded . . . . *N. muskoka.*
Ontario.
Profile of nose straighter . . . . 6.
6. Pigment of band reddish . . . . *N. anogenus.*
Blue Lake, Ind.
Pigment of band black . . . . *N. atrocaudalis.*
Palestine, Texas.

This may be supplemented by a table of measurements:

	Maximum depth (mm.)	Depth of caudal peduncle (mm.)
N. kendalli	11	4
N. muskoka (Ontario)	$10\frac{2}{3}$	$4\frac{2}{3}$
N. heterodon	10	$4\frac{1}{2}$
N. anogenus	10	$3\frac{3}{4}$
N. cayuga	8	$3\frac{3}{4}$
N. bifrenatus	8	$2\frac{3}{4}$

The scales of this subgenus are thin, and often very feebly sculptured. *N. muskoka* from Orillo, Ontario, has quite strongly sculptured scales, with the maximum number of radii for this group, sometimes as many as 24, counting the rudimentary ones. It should therefore be regarded as the nearest to the stem-form of *Chriope*.*

The following table is based on the scales:

Scales broader than long.

Scale much broader than long.

Sculpture distinct, radii 18 to 24 . . . . *N. muskoka* Meek.

Sculpture weak.

Radii 11 to 13 . . . . *N. kendalli* Evermann & Cockerell.

Radii 9 or 10 . . . . *N. cayuga* Meek.

Scale somewhat broader than long.

Sculpture distinct; size medium; radii 14 to 20 . *N. heterodon* Cope. Indiana.

Sculpture distinct; size small; radii 9 to 11 . . *N. bifrenatus* Cope.

(*N. heterodon* has thin scales, the radii irregular and wavy.)

Scales subcircular.

Scale large; sculpture distinct; radii 12 or 13 . *N. atrocaudalis* Everm. Palestine, Texas.

Scale small; sculpture weak.

Radii 12 or 13 . . . . *N. anogenus* Forbes.

Radii 7 or 8 . . . . *N. maculatus* (Hay).

N. bifrenatus agrees with *heterodon* in having the scales broadly rounded apically.

A provisional scheme of evolution may be suggested—

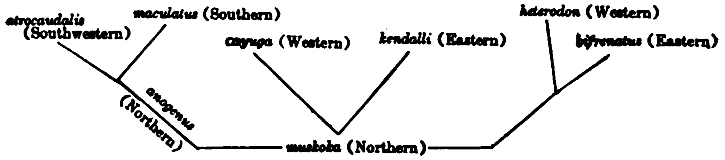

Figure 1.

N. jordani Eigenm. & Eigenm. has not been seen.

Chriope appears to have developed from a Luxiloid type independently of the other subgenera; or at least, the other subgenera are not in its ancestry.

ALBURNOPS Girard.

We know little about this group, having only three species. So far as the scales go, the obvious suggestion would be that *N. blennius* arose from the *muskoka* type. It is a small fish with large, thin, exceedingly broad scales, greatly resembling those of *muskoka*. It has more radii than the other two species examined. *N. spectrunculus* has the scales much smaller, with more distinct sculpture. *N. scylla* is in some ways intermediate.

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* According to the teeth, *N. heterodon*, with teeth sometimes 2, 4-4, 2, as in *Luxilus*, should rather be the stem-form.

The following table separates our three species:

Large fish with broad dorsal as well as lateral dark bands; scales subcircular, rather small, sculpture distinct but not strong, radii 9 to 12 . . . . *N. scylla* (Cope).
Boulder County, Colorado.
Small fish with reddish back, and no distinct dorsal band; scales broader than long.
  With a distinct caudal spot; scales small, radii 10 to 12
N. spectrunculus (Cope).
Swannanoa R., Black Mt., N. C.
  No distinct caudal spot; scales large, very broad, radii 15 to 18
N. blennius (Girard).
Guadalupe R., Texas.

HUDSONIUS Girard.

The scales of the four species we possess can be separated thus:

Scales very broad.
  Size medium . . . . *N. piptolepis* (Cope).
Boulder County, Colorado.
  Size very small . . . . *N. gilberti* Jordan & Meek.
Scale moderately broad.
  Larger, broader . . . . *N. hudsonius* (DeWitt Clinton).
Chautauqua Lake, N. Y.
  Smaller, rounder . . . . *N. illecebrosus* (Girard).
Spring Brook, Neosho, Mo.

The junior author has tabulated them as follows:

Sculpture of scales distinct.
  Radii 11 to 14; scale large . . . . *N. hudsonius*.
Sculpture weak.
  Scale of medium size.
    Nuclear area broad; radii 14 to 18 . . . . *N. piptolepis*.
    Nuclear area round; radii 8 to 10 . . . . *N. illecebrosus*.
  Scale very small; radii 9 or 10 . . . . *N. gilberti*.

The fishes themselves may be tabulated thus:

Head short; large species (Great Lakes southeastward) . . *N. hudsonius*.
Head comparatively large; small, slender species.
  Eye very large (Lower Arkansas R. basin) . . . . . *N. illecebrosus*.
  Eye moderate . . . . *N. gilberti* and *N. piptolepis*.

We do not seem to find a stem-form here; the arrangement would seem to be—

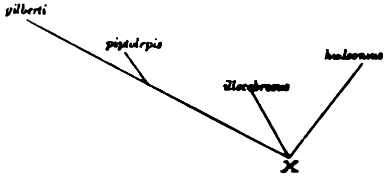

Figure 2.

On account of the teeth, *Hudsonius* can not be derived from *Chriope* or *Alburnops*. It appears to be a separate branch from the Luxiline stem.

MONIANA Girard.

Scale extremely broad, quite large; radii 6 to 13
N. lutrensis (Baird & Girard).
Boulder County, Colorado.

Scale not nearly so broad; radii 6 to 9, very far apart
N. formosus (Girard).
Colonia Juarez, Mexico.

N. formosus is a small, deep-bodied fish, the pigment so arranged as to produce a conspicuous cross-hatching. There is a dark, narrow dorsal band. Except for size, it reminds one rather of *N. cornutus*.

This group seems to be a separate branch from the Luxilines, but considerably modified.

CYPRINELLA Girard.

Of this large group we have only two, *N. niveus* (Cope) from Raleigh, N. C., and *N. galacturus* (Cope) from North Fork of Holston River, Saltville, Va. They are much alike; warm reddish dorsally, the sides silvery. *N. galacturus* has the eye much larger than that of *niveus*. They look just like *N. albeolus*, except that they are not so deep-bodied. (The eye of *niveus* is very much smaller than that of *albeolus*; diameter 3½ mm. in *niveus*, 5 in *albeolus*.)

The scales are moderately broad; they may be separated thus:

Radii numerous (about 16), but feeble and evanescent, close together; some specimens have rudimentary basal radii . . . . *N. galacturus*.

Radii few (about 8), more or less wavy, very far apart; sculpture distinct . . . . *N. niveus*.

Cyprinella may be derived from the Luxilines through such forms as *N. albeolus*. This applies to the species examined; we do not know whether or not the others would conform.

LUXILUS Rafinesque.

Scales large, with very distinct sculpture; radii numerous. Fishes deep-bodied, *N. cornutus* (Mitchill) large and with much dark color in dorsal region; *N. albeolus* (Jordan) smaller, and all subdorsal area pale reddish. Both have the scales very broad. *N. albeolus* reminds one of *N. atherinoides* and *jejunus* in *Notropus* s. str., but it is deeper bodied, and distinguished by the broad scales.

Nuclear area very broad, ¼ from base; radii 21 to 27; scale partly covered with rather thick skin . . . . *N. cornutus*.

Nuclear area circular, ⅓ from base; radii 19 to 23 . . . . . *N. albeolus*.
Raleigh, N. C.

We have *N. cornutus* from Cross Lake Thoroughfare, Maine, and Boulder County, Colorado, an enormous range!

HYDROPHLOX Jordan.

From this we have separated *N. coccogenis* as a subgenus *Coccogenia*, but for convenience of comparison we throw it into the following table:

Small fish, about 2 inches long, with broad, dark, very conspicuous lateral band; scales subcircular or even longer than broad, sculpture distinct, radii 5 to 8, circuli irregular . . . . *N. chalybæus* (Cope).
Buckhead Creek, Millen, Ga.

Larger fish (over 3 inches), with silvery sides and no dark band.
Scales extremely broad, with radii 16 to 20 . . . *N. coccogenis* (Cope).
Tellico R., Tenn.

Scales circular or nearly so, the base flattened, radii about 6, circuli regular . . . . *N. zonatus* (Agassiz).
White River, Arkansas.

N. universitatis Evermann & Cockerell (*N. zonatus* var., Univ. of Colorado Studies, V. 1908, p. 170).

N. zonatus and *chalybæus* are very distinct, and may not be properly associated in the same group.

NOTROPIS s. str.

Although we have a number of species of this group, the range of variation in the radii of the combined series is remarkably small. Instead of being the stem-form of the genus, as its name might suggest, this appears to be the last of the end-forms.

N. jejunus, *leuciodus*, *stilbius*, *telescopus*, *atherinoides* and *swaini* are all small fishes (but our *atherinoides* must be young) with large eye and broad lateral silvery band, very much alike. *N. arge* looks different; much larger (ours 4⅜ inches), with dark lateral band. *N. scopifer* is intermediate in size, with sides silvery; a deeper-bodied fish than *arge*, with convex back (back of *arge* is almost straight). *N. arge* has scales feebly sculptured, with few radii; *scopifer* has them strongly sculptured, the radii variable but often more numerous. *N. arge* has the distance from nostril to eye *greater* than breadth of nostril; *scopifer* has it *less*. The snout is shorter in *scopifer*.

The six species which are so much alike, separate upon external examination as follows:

Northern, deeper-bodied species, the sculpture of the scales distinct.
Eye larger, diameter 4 mm. . . . . *N. atherinoides* Rafinesque.
Medicine Hat, Canada.

Eye smaller, diameter 3 mm. . . . . *N. jejunus* (Forbes).
Red River of the North, Moorehead, Minn.

Southern species, slender-bodied; hind part of head above black or plumbeous. A conspicuous black spot at base of caudal fin; sculpture of scales weak.
Scales of lateral line with little dark spots . . . *N. telescopus* (Cope).
Indian Creek, Cumberland Gap, Tenn.

Scales of lateral line without such spots . . . . *N. leuciodus* (Cope).
Tennessee.

No such spot at base of caudal fin; sculpture of scales distinct.
  Snout shortest of the four southern species . . . . *N. swaini* Jordan.
    Comal Springs, New Braunfels, Texas.
  Snout the most pointed of the four southern species; scales very silvery . . . . *N. stilbius* Jordan.
    Clinch River, Tenn.

The species separate on scale characters thus:
Scale longer than broad . . . . 1.
Scale about as broad as long; radii far apart and irregular . *N. stilbius.*
Scale broader than long . . . . 2.
1. Sculpture very strong; radii all complete, far apart, 8 to 10 . *N. jejunus.*
   Sculpture not strong; radii not all complete, 6 to 9 . . . *N. leuciodus.*
2. Sculpture strong.
   Scale very large, circuli irregular, nucleus ⅛ from center, radii 10 or 11 . . . . *N. arge.*
   Scale large, radii 11 or 12, wide apart; lateral circuli remarkably wide apart . . . . *N. scopifer* Eignm. & Eignm.
     North Dakota.
   Scale medium, radii 7 to 10; circuli regular; nucleus ¼ from base *N. atherinoides.*
   Sculpture distinct but not strong, radii 9 or 10; nucleus ⅓ from base; scale covered with skin . . . . *N. swaini.*
   Sculpture weak; radii 5 to 7, far apart; circuli regular; nucleus ¼ from base . . . . *N. telescopus.*

We have considered whether this large genus might be subdivided. It would be possible to separate Luxilus; but inasmuch as most of the other subgenera appear to radiate from this type, it would apparently be necessary to regard nearly all of them as independent genera, if any. Perhaps at some later date, with more experience and better materials, a division of the genus may be undertaken, but it does not seem practicable at present.

For nearly all the specimens used in this paper we are indebted to the U. S. Bureau of Fisheries.

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PROCEEDINGS
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SOME REMARKABLE NEW LEAF-HOPPERS OF THE FAMILY FULGORIDÆ.

BY ELMER D. BALL.

While collecting Homoptera upon the burning sands of a Southern California desert a few years ago, the writer came upon a leaf-hopper of grotesque and unusual appearance, in that it stood almost upright upon its long and apparently unwieldly legs. Short and stout with a body almost as round as a pea, on which rested the rudimentary brachypterous elytra and above which projected a long, pointed, cephalic process, the insect would have attracted attention in any case. When, however, this bizarre form was coupled with an upright posture and a peculiar strut or swagger in locomotion, the resemblance to a pot-bellied Brownie of the children's page was complete.

Further collecting in similar situations in the arid West revealed a number of related forms possessing the elongated legs and a more or less upright posture. These forms also agreed in another particular, the rostrum in every case was remarkably long, in some of the more upright species extending beyond the tip of the abdomen. This, on further study, appeared to be an adaptation to the upright habit, as the insect instead of carrying its rostrum inclined forward as most leaf-hoppers do in feeding, fed with the rostrum running down along the abdomen, and extending beyond it into the plant tissue. The whole arrangement was apparently an adaptation for the purpose of raising the insect's body to escape the burning heat of the sands.

Ten species in all were found in the Western States, only one of which, *Orgerius rhyparus* Stal, has been described. The remaining nine species, the types of all of which are in the author's collection, are described below.

Orgamara gen. nov.

Resembling *Orgerius* Stal but with the vertex produced into a long stylate process, similar to that found in *Scolops*, but stouter.

Vertex and front produced into an elongate, nearly rectangular process, several times longer than its basal width, straight or slightly upturned, the margins carinate, the lateral carinae of the front running obliquely from below the eye to the dorsal surface of the process before the middle. Lateral surfaces of the process below the carinae pustulate. Front with the tricarinate central tablet forming the lower surface of the process. Pronotum with the central raised tablet tricarinate, the lateral extensions sloping strongly downward and backward, pustulate. Elytra stout, coriaceous, irregularly reticulate, covering scarcely half the abdomen. Wings rudimentary. Legs all slender, hind tibia with about six or seven spines. Rostrum about equalling the tip of the abdomen.

Type of the genus *O. acuta*.

Orgamara acuta sp. nov.

Long, slender, dark, with a light spot on each elytron. Process slender, tapering. Whole insect resembling a dark *Scolops* larvae. Length, ♀ 5¾ mm.; ♂, 5 mm.

Cephalic process as seen from above, long, narrow, slightly tapering to the truncate apex, which is less than half the width between the eyes. Process as seen from the side, broad, slightly tapering, both margins straight to the truncate tip. Front long and slender, one-half its length before the eyes, the lateral carinae of the central tablet distinctly narrowing towards the clypeus. Clypeus slender, slightly convex, strongly carinate. Pronotum long and very slender, the lateral pieces curving around the mesonotum, forming an inverted V. Mesonotum very long. Elytra short, coriaceous, obliquely truncate, the inner angles rounded, covering less than half the abdomen. Venation irregularly reticulate. Abdomen convex, indistinctly tricarinate.

Color.—Dark smoky brown, the front, clypeus and plurae tawny brown, pustules on lateral face of process, pronotum, and a row on each abdominal segment outside the lateral carinae milky white. The nervures near the apex of each elytron are marked with white, forming an irregular white spot, and the lateral abdominal carinae are light.

Described from a pair from Ti Juana, Mexico, and a single male from San Diego, California, collected by the author.

Orgamara reducta sp. nov.

Resembling *acuta* but stouter, lighter colored and with a shorter process. Length, ♂, 4 mm.

Cephalic process slightly broader than in *acuta* and considerably shorter, tapering to the truncate tip; tip one-half the basal width. As seen from the side, the process is broad, distinctly tapering, the margins straight to the truncate tip. Front broader and shorter than in *acuta*. One-third its length extending beyond the eyes. Pronotum shorter and less curved than in *acuta*. Mesonotum broader and shorter. Elytra longer and with the outer margin more flaring, obliquely truncate. Abdomen broader and shorter than in *acuta*.

Color.—Pale, peppered with dirty brown, a faint, broad, median light stripe from the basal third of vertex back onto elytra. A transverse light band just before the apices of the elytra. The abdominal carinae broadly light.

Described from a male from Cabazon, California, collected by the author.

Orgamara obesa sp. nov.

Resembling *reducta* but stouter, with a much stouter and slightly elevated cephalic process. Length, ♀, 6 mm.; ♂, 5 mm.

Cephalic process stout, almost parallel margined, with the apex slightly rounded. Whole process inclined upwards. As seen from the side, slightly tapering, the margins straight. The superior margin rounding over at the apex, the inferior apical angle slightly acute, accentuated. Front parallel margined, part above the eyes but little longer than that below. Central raised tablet occupying the entire apical portion, slightly narrowing to the weakly convex clypeus. Rostrum long, reaching to the base of the genitalia. Pronotum short, dorsal surface distinctly inclined in line with the cephalic process. Elytra abbreviate, the inner angles broadly rounding.

Color.—Pale straw, slightly washed with orange and sprinkled with smoky brown, giving the whole insect a dirty orange cast. Cephalic process pale, sparsely dotted with fuscous, about three pairs of heavier spots along the outer carinae just below the apex. Clypeus reddish orange. Pronotum and scutellum pale, sparsely dotted. Elytra with the nervures pale straw, the cells smoky.

Genitalia.—Lower half of anal tube in the male extending twice the length of upper half, expanding into a broad, flat plate with two rounding lobes which partly enclose the narrow, elongate plates, apex emarginate, surface smooth.

Described from three specimens from Parowan and American Fork, Utah, collected by the author.

Orgamara bipunctata sp. nov.

Resembling *obscura* but with a longer, less inclined process and darker color. Length, ♀, 6.25 mm.; ♂, 5.25 mm.

Cephalic process long, parallel margined to the apical third, where it is slightly tapering. As seen from the side, very long and slender, the apex rounding over from above, with the lower angle strongly produced. Whole process longer, less inclined than in *obesa*. Front, with a central raised tablet distinctly narrowing before the eyes, then parallel margined to the clypeus. The part of the front above the center of eyes almost double in length that below. Body slenderer than in *obesa*, the sides of the pronotum strongly sloping. Elytra short, slightly obliquely truncate.

Lower half of anal tube in male still longer and more appressed than in *obscura*. Apical margin strongly convex, surface rough and hairy.

Color.—Pale, heavily finely irrorate with fuscous brown. A pair of round white spots just inside the apices of the abbreviate elytra and a pair of light stripes extending from these to the apex of the abdomen. Front greenish, about four pairs of dark areas on the outer carinae. Clypeus orange.

Described from seven examples from St. George, Utah, collected by the author.

Orgamara obscura sp. nov.

Resembling *bipunctata* in size and form, slightly shorter; paler, with a shorter process. Length, ♀, 6 mm.; ♂, 5 mm.

Cephalic process stouter and shorter than in *bipunctata*, parallel margined with the apex slightly roundingly narrowing. As seen from the side, slightly tapering, the apex rounding above; right angled below. Front with the median tablet expanded before the apex, then tapering to clypeus. Part of front above the center of eyes one-half longer than that below. Pronotum and elytra as in *bipunctata.*

Color.—White, finely sprinkled with dark points, giving the whole insect an ashy gray appearance. Traces of the white spots and stripes as seen in *bipunctata*. Front greenish, the clypeus rusty orange.

Genitalia.—Lower half of anal tube in the male extended over one and one-half times the length of tube, broadly expanded and curved down to meet the margins of the long, narrow plates. Surface of the lower half furrowed and clothed with coarse hairs.

Described from eight specimens from Nampa, Idaho, collected by the author.

Orgamara albida sp. nov.

Larger and lighter colored than *bipunctata*, with a long, stout, strongly curved cephalic process. Length, ♀, 7 mm.; ♂, 6 mm.

Cephalic process long, parallel margined to the apex. As seen from the side, stout, parallel margined or slightly widening toward the apex. Apex slightly obliquely truncate. The superior angle slightly acute. Front long, almost two-thirds of the length in front of the center of eyes, median tablet occupying the entire apical portion, narrowing to the clypeus where it occupies less than half the width of the front. Median carina elevated toward the apex of the process, rendering it pentagonal in outline. Pronotum broad, its interior margin less curved than in *obscura.* Elytra very short, scarcely as long as broad, truncate with the inner angles rounding. Legs very long, the rostrum extending to the apex of abdomen.

Color.—Pale straw, often scarcely marked above except for a smoky shade to the abdomen and a few black dashes along the margins of the segments. A pair of dark, smoky stripes commencing before the eyes and extending back along the sides of the face, and on below the margins of the elytra.

Genitalia.—Anal tube of male with the lower portion extending slightly obliquely beyond the upper, but not flattened or expanded. The inferior angles of the last abdominal turgum extended into acute spine-like processes.

Described from eight examples from Mojava, California, collected by the author. Readily separated from any other species of the genus by the paler color and the enlarged apex of the cephalic process.

Timodema gen. nov.

Resembling *Tiridia* Uhler but with a broader outline and the first two pairs of legs broadly foliaceous.

Vertex short, horizontal, not extending to apex of head, broad with a median carina and an angulate anterior margin. Front but slightly produced in front of the eyes, scarcely angulate, as seen from the side. Median tablet distinctly elevated, tricarinate, the median carina extending but little below the middle. Clypeus broad, distinctly carinate. Pronotum broad and short, tuburculate. Mesonotum weakly tricarinate, tuburculate outside the lateral carinae. Elytra short, broad, shorter than the abdomen, coriaceous, with the two principal longitudinal nervures irregularly forked. Surface of elytra irregularly covered with reticulate veins. Wings rudimentary. Anterior femora and tibia broadly foliaceous, the tibia tapering down to the small tarsal segments. Middle femora and tibia similarly, but not so broadly foliaceous.

Type of the genus *T. miracula.*

Timodema miracula sp. nov.

Superficially resembling *Tiridia cingulata* Uhl. Slightly larger, broader and darker. Short and stout, dark brown, with two white spots on the elytra. Length, ♀, 4 mm.; width, 2.75 mm. Male slightly smaller.

Vertex as broad as long, distinctly angled in front, half the length of the head, the margin sharply carinate. Front rounding over from vertex, as seen from the side, nearly parallel with eyes, slightly angulate at apex and elevated from the surface of the eyes about one-half its width. A tricarinate elevated median tablet extending from the apex of head to clypeus. Medium carina wanting on the narrowed lower half, surface of front except the median tablet tuburculate. Clypeus large, slightly inflated, distinctly tricarinate. Pronotum broad, very narrow behind the eyes, pustulate. Mesonotum distinctly tricarinate with a single row of pustules from the outer angles to the lateral carinae. Elytra wider than long, truncate posteriorly, covering only one-half the abdomen, coriaceous with minute anastomosing veinlets and apparently two main longitudinal veins, the outer one irregularly forked. Abdomen broad with a median carina. Anterior femora nearly one-half wider than the front.

Color.—Dark brown with an ivory white band just before the apex of each elytron and irregularly yellowish white markings as follows: a dot against either eye, a transverse area at the base of the mesonotum, a tri-

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THE SCALES OF THE COBITID AND HOMALOPTERID FISHES.

BY T. D. A. COCKERELL.

According to Boulenger, the Cobitids and Homalopterids form subfamilies (Cobitidinæ and Homalopterinæ) of the Cyprinidæ. Gill, as far back as 1861, proposed to treat both groups as distinct families, Cobitidæ and Homalopteridæ, a course in which he has been followed by several writers. Having regard for all the characters, it seems that we may recognize a distinct family Cobitidæ, but the Homalopterids may be regarded as very aberrant Cobitids. The arrangement will then be as follows (using the characters cited by Gill and Boulenger):

COBITIDÆ. Maxillaries not bordering the mouth, barbels three to six pairs; pharyngeal teeth in one row; air-bladder with a long capsule; scale small or absent.

(1) *Cobitinæ*. Air-bladder variably modified or reduced, but always distinct.

(2) *Homalopterinæ*. Air-bladder rudimentary. Curiously flattened fishes, adapted to life in mountain streams, where they are able to adhere to the rocks in a strong current.

Gyrinochilus Vaillant, regarded by Gill as the type of a family Gyrinochilidæ, is certainly very different from these, and has large scales. I regret that I have never seen a specimen.

The scales of the Cobitidæ, as here defined, appear to be of a sufficiently uniform type. In the genus *Misgurnus* of the Cobitinæ they are relatively large and well developed, and have an exceedingly beautiful pattern. They are fairly large, however, in *Homaloptera*.

(1) ***Misgurnus fossilis.*** (River Volga, Astrakan; Moscow Univ., B. Mus.) Scales about 2 mm. diameter, subcircular, rather broader than long; nuclear area very near the base, not granular, with fine radii (averaging about 50 μ apart) extending in all directions, the latero-basal ones with a graceful downward curve. About 23 radii start from the vicinity of the nucleus, but as they diverge the intervals are filled by supplementary radii, so that the spacing throughout is fairly uniform. Circuli moderately dense, not differentiated in the apical area.

(2) ***Misgurnus anguillicaudatus.*** (Shanghai; *Swinhoe;* B. Mus.) The largest Cobitid scale known to me. Transverse diameter about 3 mm. or a little over; structure as in *M. fossilis*, except that in the apical field there are at intervals much stronger circuli, giving a strongly ribbed or cancellated effect. The scale is considerably broader than long.

(3) ***Cobitis tænia.*** (Goto Is., Japan; *Gordon Smith;* B. Mus.) Scales thin, transversely oval, about 460 μ long and 600 broad; radii all around, but relatively few, about 14 may be considered apical; circuli only moderately dense. A scale of the same general type as that of *Misgurnus*, but much smaller and weaker. Among the Cyprinids proper, it closely resembles that of *Chrosomus*.

(4) ***Cobitus guntea.*** (Calcutta; *F. Day;* B. Mus.) Scale very different from that of *C. tænia;* it is much elongated, oblong, about 1360 μ long and 780 broad, with very distinct and beautiful sculpture of the *Misgurnus* type, but with the circuli in the apical region widely spaced, giving a cancellated effect, many of the spaces formed by the intersection of the circuli and radii diamond-shaped. The circuli are very numerous, and the nuclear area is very near (about 170 μ from) the base. This is generically distinct from *C. tænia*.

(5) ***Cobitis gongota.*** (N. E. Bengal; *Jerdon;* B. Mus.) Scales greatly elongated, rounded apically, the base flattened or truncate; length about 1275 μ, breadth 630; nucleus about 200 μ from base. This is of the same general type as *C. guntea*, but very distinct by the fewer radii and circuli. Thus there are 8 or 9 apical radii (not counting lateral ones) and about 11 or 12 apical circuli; in *C. guntea* there are at least twice as many.

(6) ***Lepidocephalichthys berdmorii.*** (Nampandet, Shan States, alt. 2000 ft.; *Oates;* B. Mus.) Scale shaped exactly as in *C. gongota* (length about 1370 μ), and with quite the same sort of sculpture. The apical radii are perhaps rather less numerous, but there are more (about 23) apical circuli. The difference is such as might be expected between two closely allied species.

The above are all Cobitinæ; the following three are Homalopterinæ:

(7) ***Gastromyzon borneensis.*** (Senab, Sarawak; *Everett;* B. Mus.) Scale oblong, subquadrate, the base obliquely truncate, more or less

asymmetrical; length of scale about 1190 μ, breadth about 850; sculpture much as in the last two species; basal and apical radii well developed, latter variable and more or less broken; apical about 13, the outer ones curving basally toward the nucleus; circuli widely spaced. Lateral line scales have the radii fewer and the circuli closer. The nucleus is about 290 μ from base. There is nothing whatever in these scales that affords any radical distinction from the Cobitines, especially *Lepidocephalichthys*.

(8) *Homaloptera maculata*. (Khassya; *Jerdon;* B. Mus.) A very curious fish, the under side flat. (By no means so specialized as *Gastromyzon*, however.) Scales fairly large, nearly 2 mm. long, and nearly as broad; apex broadly rounded, base flattened; radii all round, strong, not very close (about 15 apical), very short, owing to the very large nuclear area, over which are scattered spots arising from the breaking up of the central parts of the radii, the width of this nuclear area is about 850 μ; circuli widely spaced. The sculpture here is essentially as in *Gastromyzon*, etc., except for the remarkably modified central region.

(9) *Homaloptera brucei*. (Meekalan, Tenasserim; *Fea;* B. Mus.) Scales smaller, about 1275 μ long, and broader, but of entirely the same pattern. The apical radii are irregular and more or less broken up.

The Cobitinæ have their headquarters in the Indian region, where Day recognized nine genera and 46 species. (*Botia*, 6 species; *Acanthopsis*, 1; *Somileptes*, 1; *Lepidocephalichthys*, 3; *Acanthophthalmus*, 1; *Apua*, 1; *Jerdonia*, 1; *Nemachilichthys*, 1; *Nemachilus*, 31.) From Japan, Jordan and Fowler recognized (1903) five genera and six species. The only African genus is *Nemachilus* (*N. abyssinicus* Blgr., Lake Tsana, Abyssinia). *Misgurnus*, *Acanthopsis* and *Cobitis* get as far west as France. Not a single species has reached America. Three species of *Cobitis* occur in the Upper Miocene beds at Oeningen (Wangen), Baden; I have examined specimens of them in the British Museum.

The Homalopterinæ, with four genera, are exclusively Asiatic, occurring in China and India, and the Malay Peninsula and Archipelago.

It seems rather remarkable that a group so diverse, and in some of its members so specialized, and therefore probably of great antiquity, should not have spread more widely. No doubt the carnivorous Characinids may have proved an obstacle in Africa, and it must also be remembered that the past distribution may have been wider than the present. The discovery of a fossil Cobitid in America may not be altogether out of the question.

The scales, all of essentially the same type, are more or less degenerate, but hardly specialized. They appear to represent the earlier type of Cyprinoid scale in a weak form, and that is why they remind one of certain scales of various genera of true Cyprinidæ.

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THE CYPRINID SUBFAMILY CHONDROSTOMINÆ.

BY T. D. A. COCKERELL.

Some time ago, when working on the North American Chondrostominæ, I was warned by Dr. Jordan to compare the European *Chondrostoma*, as it might be found that the supposed close relationship did not exist. This was not possible at the time, but I now have before me scales of five species of *Chondrostoma*, and have made the necessary comparisons. On the whole it must be said that there is sufficient resemblance to strongly indicate that the affinities assured from the jaw-characters, teeth, etc., are not illusory. Restricting the American Chondrostominæ to *Acrocheilus* and *Orthodon*, there seems to be no reason why these should not be placed in the same subfamily as *Chondrostoma*, and regarded as an offshoot from the Old-World group, which doubtless reached America in Miocene times. *Oxygeneum* I have never seen; it is said to have the form of *Moxostoma*, and I suppose it to come of quite different stock from the Chondrostomines.

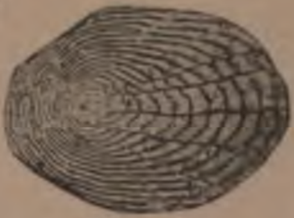

Figure 1.
Scale of *Orthodon microlepidotus*.
San Miguel, Calif.

The Chondrostominæ, according to scale-characters, may be classified as follows:

(A) Tribe Chondrostomini. Palæarctic fishes; scales relatively large, about as broad as long, retaining the prominent, lateral basal angles (as in the American *Moxostoma* and *Carpiodes*); lateral circuli very numerous . . . genus *Chondrostoma* Agassiz.

Group 1. Scales rather small; apical radii numerous, about 12 to 14; basal radii well developed . . . *C. polylepis* and *C. meigii*.
Both from S. Domingo de Silos, Burgos, Spain, (*Gonzales*); Brit. Museum.

Group 2. Similar to the last (both have the nuclear area basad of the middle), but apical radii fewer, 7 or 8 . . . *C. knerii*.
River Arga near Pamplona (*A. T. D. Berrington*); Brit. Museum.

Group 3. Scales large, about 8 mm. diameter; apical radii few, 5 or 6, wide apart; nuclear area little basad of the middle.
C. nasus L.;
Visoko Fojnica, Bosnia (*Dr. F. Werner*); Brit. Mus.
C. soëtta.
River Mincio, Italy (*Dr. F. Werner*); Brit. Mus.

(B) Tribe Acrocheilini. Fishes of Pacific slope of North America; scales very small, oval to subcircular, without latero-basal angles; basal radii evanescent; apical radii few; lateral circuli very few as compared with the European group; apical circuli (between the radii) widely spaced; nuclear area far basad of the middle.

(1) Lateral circuli about 15 . . . . . . *Orthodon microlepidotus*.
San Miguel, California.

(2) Lateral circuli about 12; nuclear area rather more basal; apical circuli more widely spaced, but general features of scale as in *Orthodon* . . . . *Acrocheilus alutaceus*.
Payette River, Idaho.

So far as the scales go, it must be held that the European group is certainly the more primitive one. It is also to be noted that species of *Chondrostoma* have been found in the Upper Oligocene or Lower Miocene of Bohemia.

All the scales described are from the vicinity of the lateral line, at the evel of the beginning of the dorsal fin.

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ON THE VALIDITY OF THE NORTH AMERICAN CYPRINID GENUS *NOTEMIGONUS.*

BY T. D. A. COCKERELL.

The genus *Notemigonus* Rafinesque 1819 (type *auratus* = *chrysoleucas*) has in recent years been treated, not without doubt, as a subgenus of *Abramis*, from which it is said to differ by the much shorter anal fin with 9 to 18 rays instead of 20 to 40 (Jordan and Evermann, Fishes of North and Middle America, Part 1, p. 250).

A study of the scales shows, I think conclusively, that *Notemigonus* is really very distinct from *Abramis*. *Notemigonus chrysoleucas* (Mitchill) is a rather small fish with relatively, but not absolutely, large scales, which agree closely with those of *Opsopoeodus** (*O. oculus* Evermann). The genus also agrees with *Opsopoeodus* in its serrate or crenate pharyngeal teeth, and I consider the two to be closely allied, forming a little group. The scales of both are thin and broad, with the nuclear area subbasal, the radii all apical, few and far apart, and the apical circuli very far apart (for circuli), especially in *N. chrysoleucas*.

The type of *Abramis* Cuvier, 1817, is *A. brama*. This is a large fish with great subquadrate yellowish scales, in a specimen before me (Lough Erne, *Maj. H. Trevelyan*; Brit. Mus.) 18 mm. long and 21½ broad. The circuli are innumerable and extremely dense in the manner of so many Old World cyprinids. The nuclear area is practically central; and the radii, which are all apical are extremely numerous and close together, in the middle actually 6 or 7 to a millimeter! It would be difficult to imagine a scale with any cyprinid features, more totally diverse from that of *Notemigonus*. The pharyngeal teeth of *Abramis brama* are also diverse from those of *Notemigonus*, and are not serrate or crenulate.

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* See Proc. Biol. Soc. Wash., XXII (1909), Pl. III, for *O. oculus*.

Ballerus Heckel, 1843, is probably a distinct genus. The scales of *Ballerus ballerus* or *Abramis ballerus*, from the Danube, have the general form, and the extremely fine circuli, of *Abramis brama*, but the radii, which are all apical, are reduced to from four to six, and these are mostly broken and incomplete. This is an independent development, not at all approaching *Notemigonus*.

Abramis vimba (L.) (Olmütz, *Jeitteles;* Brit. Mus.) typifies another rather distinct group, the scales shaped nearly as in *A. brama* (L.), the nuclear area central and broadly granular, the circuli next to the nuclear area not dense, apical radii only about 12, some evident but feeble basal radii. This is entirely different from *Ballerus* in the nuclear region, which in the latter has very fine circuli practically to the middle with no granular area.

Abramis sopa Pall., from Astrachan, falls in the same group as *A. vimba* on scale-characters, but the circuli are much closer, and there are no basal radii.

Abramis blicca Bl. (genus *Blicca* Heckel) may also be referred to the same group, but the nuclear area is very broadly granular, the fine granulations extending even among the circuli at the sides. The apical radii, about 13, are more or less incomplete; there are two or three imperfect basal radii.

Abramis elongatus Ag. (Würm See, Bavaria, *Prof. v. Siebold;* Brit. Mus.) has scales which are quite distinctive; the nuclear area very distinctly basad of the middle (herein approaching *Notemigonus*), without a granular area; the circuli rather less dense than in most species; the apical radii five or six, with one or two others rudimentary; basal radii represented by feeble rudiments. There is a certain resemblance to *Ballerus*.

Abrama buggenhagi Bloch (canal at Slough, *Ling* and *Ladbrook;* Brit. Mus.) is referable to the subgenus *Abramidopsis* Sieb. The scales show a central nuclear area, without granulations; basal radii evident and rather numerous; apical radii apparently only three or four, but on close inspection numerous parallel rudimentary radii or furrows are visible, showing some resemblance to the structure found in *A. brama*. *Abramis buggenhagi* is considered to be a hybrid between *Abramis brama* and *Leuciscus rutilus*. Its scale may fairly be said to resemble a "composite portrait" of the scales of these two fishes, with, however, a considerably greater resemblance to that of *L. rutilus* than that of *A. brama*. The basal part of the scale is quite in the manner of *L. rutilus*. In Mendelian terms, one might say *L. rutilus* dominant, but the dominance not quite complete.

The classification of the fishes under discussion will then be as follows:

(A) European fishes with dense circuli, and nuclear area nearly always central or nearly so.

Abramis Cuvier.

(a) *Abramis* s. str. A. brama *L.*
(b) *Abramidopsis* Sieb. A. buggenhagi *Bloch*.

(c) *Blicca* Heckel. A. blicca *L.*, A. sopa *Pall.*, A. vimba *L.*
(d) Group? A. elongatus *Ag.*

Ballerus Heckel.

B. ballerus *L.*

(B) American fishes, not closely related; circuli not dense; nuclear area subbasal.

Notemigonus Rafinesque.

Notemigonus chrysoleucas (*Mitchill*).
Notemigonus chrysoleucas bosci (*Cuv.* and *Val.*).
Notemigonus gardoneus (*Cuv.* and *Val.*).

The scales described were in every case taken from the vicinity of the lateral line, at the level of the beginning of the dorsal fin.

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PROCEEDINGS

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BIOLOGICAL SOCIETY OF WASHINGTON

THE NOMENCLATURE OF THE AMERICAN FISHES USUALLY CALLED LEUCISCUS AND RUTILUS.

BY T. D. A. COCKERELL.

The structure of the scales in European *Leuciscus* and *Rutilus* is so different from that of the American fishes assigned to these genera, that the latter must evidently be separated. It will be useful, for the sake of comparison, to briefly describe the characters of the scales of the principal European groups:

(1) *Leuciscus* Cuvier.

L. leuciscus (L.). Scale rather broad; latero-basal angles strong; lateral circuli extremely numerous; apical circuli about half as many; basal radii well developed; apical radii about five, very strong, with several incomplete (peripheral) ones between; nuclear area a short distance basad of middle, with no granular patch. (Gefle, Sweden; *Wheelwright;* B. Mus.)

(2) *Rutilus* Raf.

L. rutilus (L.). Scale very large, diameter about 12 mm.; latero-basal angles strong; lateral circuli extremely numerous; *apical circuli not different from lateral;* basal radii strong, but few; apical radii about five, speading, very strong, with intermediate ones suggested by obscured grooving and marginal crenulation; nuclear area central, circulate nearly to middle. (Salisbury, England; *Ogden Smith;* B. Mus.)

(3) *Pigus* Bp.

L. pigus. Scale much as in *L. rutilus*, but not so large; nuclear area basad of middle, apical grooves and crenulations very distinct. This undoubtedly falls in the same group as *L. rutilus.* (Lombardy; B. Mus.)

(4) *Cephalus* Bp. (= *Squalius* Bp.?)

L. cephalus (L.). Scale like *L. leuciscus*, but (at least in specimens examined) larger. *Nuclear area conspicuously apicad of middle;* almost no marginal rudiments of apical radii; apical circuli not so strongly differentiated from lateral ones. The basal radii are numerous and close together. (Gotha River, Sweden; *Lloyd;* B. Mus.)

(5) *Idus* Heck.

L. idus (L.). Scale of same general type as *L. leuciscus*, with the same strong differentiation between lateral and apical circuli. (Munio River, Lapland; B. Mus.)

(6) *Scardinius* Bp.

S. erythrophthalmus (L.). Scale as in *L. pigus*, but even fewer apical radii (four, widely spreading). Apical circuli same as lateral. (River Cam, Newport; *F. Templeman;* B. Mus.)

(7) *Phoxinus* Raf.

P. phoxinus (L.). Scale minute, broad, with radii all around; of same type as those of *Chrosomus* and *Tiaroga*. (Merioneth; B. Mus.)

The following is from North Africa:

(8) *Phoxinellus* Heck.

P. chaignoni (Vaillant) = *callensis* according to B. Mus. label. Scale minute, broad, slightly triangular; circuli few; nuclear area subbasal; apical radii about ten, spreading; *no basal radii;* lateral circuli about 18 to 20. (Oued el Mahd; and Oued Abdallah, Tunis; Paris Mus.; B. Mus.) These scales are extremely distinct from those of all the groups given above; the resemblance to those of *Phoxinus* is merely superficial.

The Japanese *L. jouyi* and *L. hakuensis* are not closely related to (or, apparently, even congeneric with) any of the above groups. They show a strong approach to the American types.

The American fishes, so far as known to me, may be arranged as follows:

RICHARDSONIUS Girard. (*Leuciscus* Auctt. Amer.)

For table of species, see Proc. Biol. Soc. Wash., XXII, p. 159.

(1) Subgenus *Temeculina* nov.

Scales of elongate type, with basal radii.

Richardsonius orcutti (Eigenm. & Eigenm.).

(2) Subgenus *Tiogoma* Girard.

Richardsonius pulchellus (Baird and Girard); syn. *Leuciscus nigrescens* (Girard).

Richardsonius pulchellus pandora (Cope). The northern subspecies. I recently examined specimens of this form from San Luis Lake, Costilla Co., Colorado (*E. R. Warren*), and was surprised to find the peritoneum black, and the pharyngeal teeth obtuse, scarcely hooked. The intestine contained seeds. *R. pulchellus* is a curiously variable species, such as one might imagine to arise from the intermingling and hybridization of several species originally distinct.

Richardsonius intermedius (Girard).

Richardsonius aliciæ (Jouy). Atypical for this subgenus.

(3) Subgenus *Clinostomus* Girard.

Richardsonius elongatus (Kirtland). Small, broad scales.

(4) Subgenus *Richardsonius* s. str.

Richardsonius balteatus (Rich.) Girard.

Richardsonius thermophilus Evermann & Cockerell.

(5) Subgenus *Cheonda* Girard.

Richardsonius egregius (Girard).

Richardsonius hydrophlox (Cope).

Richardsonius carletoni (Kendall).

These three are not very closely related, and are placed here provisionally, especially as I have not seen *Richardsonius cooperi* (Girard), the type of *Cheonda*.

(6) Subgenus *Margariscus* nov.

Type *margarita*. The so-called American *Phoxinus*, but wholly diverse from true *Phoxinus*. A small-scaled group.

Richardsonius margarita (Cope).

Richardsonius neogæus (Cope).

(7) Subgenus *Hemitremia* Cope.

Richardsonius vittatus (Cope); syn. *Leuciscus flammeus* (Jordan & Gilbert). This I have not seen.

IOTICHTHYS Jordan & Evermann.

Iotichthys phlegethontis (Cope). Scales not seen.

SIPHATELES Cope. (*Rutilus* subg. *Leucos* Auctt. Amer.)

Siphateles olivaceus (Cope). Scales very small, with few radii.

MYLOLEUCUS Cope. (*Rutilus* Auctt. Amer.)

Myloleucus thalassinus Cope.

Myloleucus symmetricus (Baird & Girard). A composite species.

Myloleucus columbianus (Snyder).

Myloleucus oregonensis (Snyder).

Myloleucus bicolor (Girard).

Myloleucus boucardi (Günther). Not seen.

The group *Siboma* Girard, I have not seen.

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